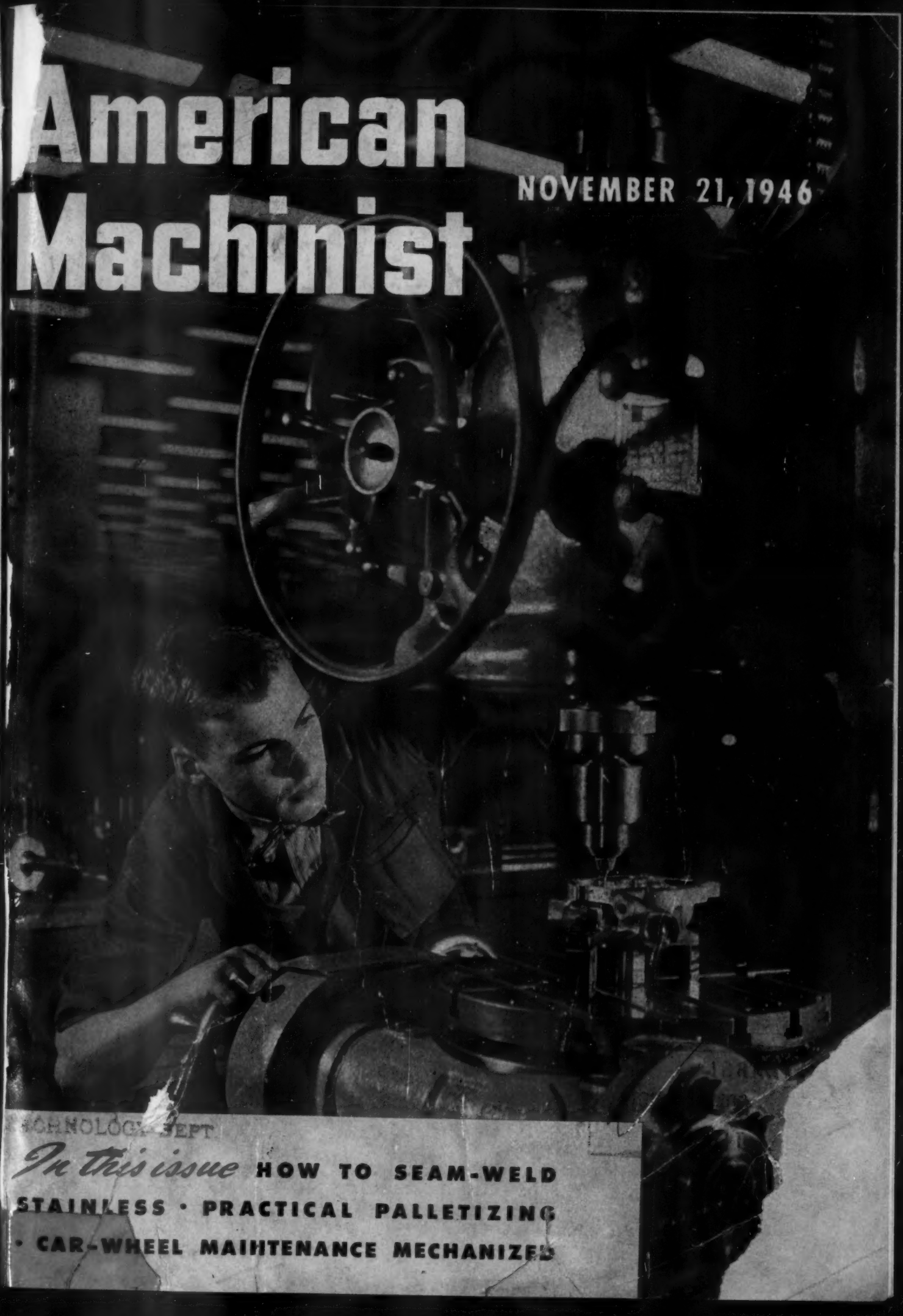
American Machinist

NOVEMBER 21, 1946



TECHNOLOGY DEPT

In this issue HOW TO SEAM-WELD STAINLESS · PRACTICAL PALLETIZING · CAR-WHEEL MAINTENANCE MECHANIZED

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e applied in your own work—we'll be
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American Machinist

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Chips and QUIPS

Boring . . . John Sundstedt, not so long ago an aide to General MacArthur, mills the sealing groove on the aluminum base for a jet governor at Woodward Governor Co. for our cover. The machine is a Pratt & Whitney jig borer; Kodachrome by M. Hans Zielke.

Request Numbers . . . Continuing our intention to do something about reader pro'lems, we present two articles in this issue, both based on plant perplexities . . . Our idea is that a shop executive, despite conferences and paper work, should spend at least half this time with the men he's supervising, not remote-controlling production from an ivory tower (see page 101) . . . And we hope some of the freight shackles may soon be stricken from pallets, so LCL shipments can achieve economy (page 113).

Like the Weather . . . The old epigram, "Everybody talks about it, but nobody does anything . . . " might well apply to machinability. Most materials ads promise easy machining, but methods to measure it still take lab units. Georg Schlesinger, world expert (see biog. right), told us on a recent visit of his simple shop tester, based on a lifetime of experiments. We asked for details, present them as a special report, our first on research. Comments?

Stainless Supplement . . . The 900 or so prewar fabricators of stainless steel swelled to over 4500 during the war. Aspirin for their seam-welding headaches is prescribed here by Doc Riley of Taylor-Winfield, whose patience has been tested by many patients.

More Materials Handling . . . The care and feeding of production is becoming increasingly important. To supplement our basic formulary on Materials Handling (June 20 *A. M.*), we take up two phases of the problem here . . . In addition to the discussion on palletizing, there's the first half of a description of the new Glenwood wheel shop of the B & O Railroad, where cranes and conveyors do the hard work (page 104).

Big Ben Needs Help . . . The British Ministry of Supply, working frantically to get England's watch and clock industry ticking again, cleaned our London office of tearsheets of "Precision in Miniature," our May 23 compendium on top methods of drilling and tapping holes. We're sending the last of our own over too, plus the information that in this issue are three pages of Shop Shots showing some other tricky operations at Hamilton Watch.

Famous Soong Sister . . . China is officially interested in modern metal-working. Among our recent renewals is that of Mme. Sun Yat-sen, who we are pleased to report is now back on Tsingkiang Road, Shanghai. Widow of China's liberator, she is the sister of Mme. Kai-Shek, and of T. V. Soong.

Apprentices . . . At Caterpillar, they worked out a technique of teaching hydraulics we thought you'd like to know about. It's here, too, as well as the final installment on electronics.

Coming . . . Dec. 5 A. M. starts our second year of special reports with "Electrical Control for Metalworking Machines," a double-checked digest . . . There'll also be scenes from the production life of a 12-lb. magnesium wheelbarrow, the dope on buffing plastics, a summary on low-alloy high-strength steels, another in the series on resistance-welding stainless, etc. It will make you late with your Christmas list.

"Yes, we read the advertisements in American Machinist *and find them often quite as valuable in suggestion as the very interesting articles that you print." W. McDougall, Pres., Ketcham & McDougall, Inc., East Orange, N. J.*

MACHINABILITY EXPERT . . . Dr. Ing. Georg Schlesinger, born in Berlin in 1874, won his engineering degree at Charlottenburg there in 1896 and his doctor's degree in 1903 with a thesis on "Fits and Limits of Engineering to Secure Interchangeability of Parts." Between degrees, he worked up from draftsman to chief designer at Ludwig Loewe, Berlin.

For 30 years, he was a professor of machine tools and plant administration at Charlottenburg, also director of research on machine tools and scientific management. But in 1934, Nazi persecution forced him to leave Germany. Until 1939 he was at Brussels University, where he created a laboratory for investigation of machine tools, then he went to England to create the research department of the Institution of Production Engineers at Loughborough. He retired in October, 1944, to become a consultant. He is the author of many important books on costs, safety, testing, design, surface finish, etc.

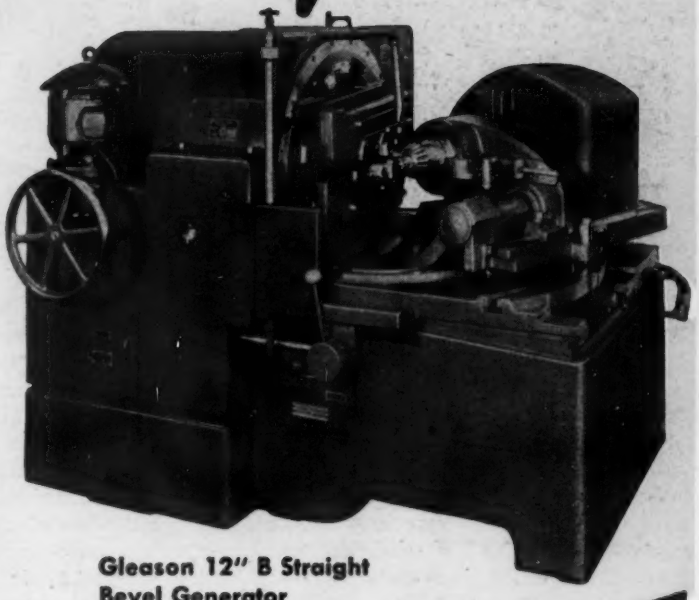
Why Use Coniflex Gears?

Coniflex gears are superior to ordinary straight bevels . . . they are the gears with localized tooth bearing . . . produced on the latest Gleason straight bevel generators in the medium and large sizes by means of a positive cam-controlled advance of the tool slides at each end of the cutting stroke.

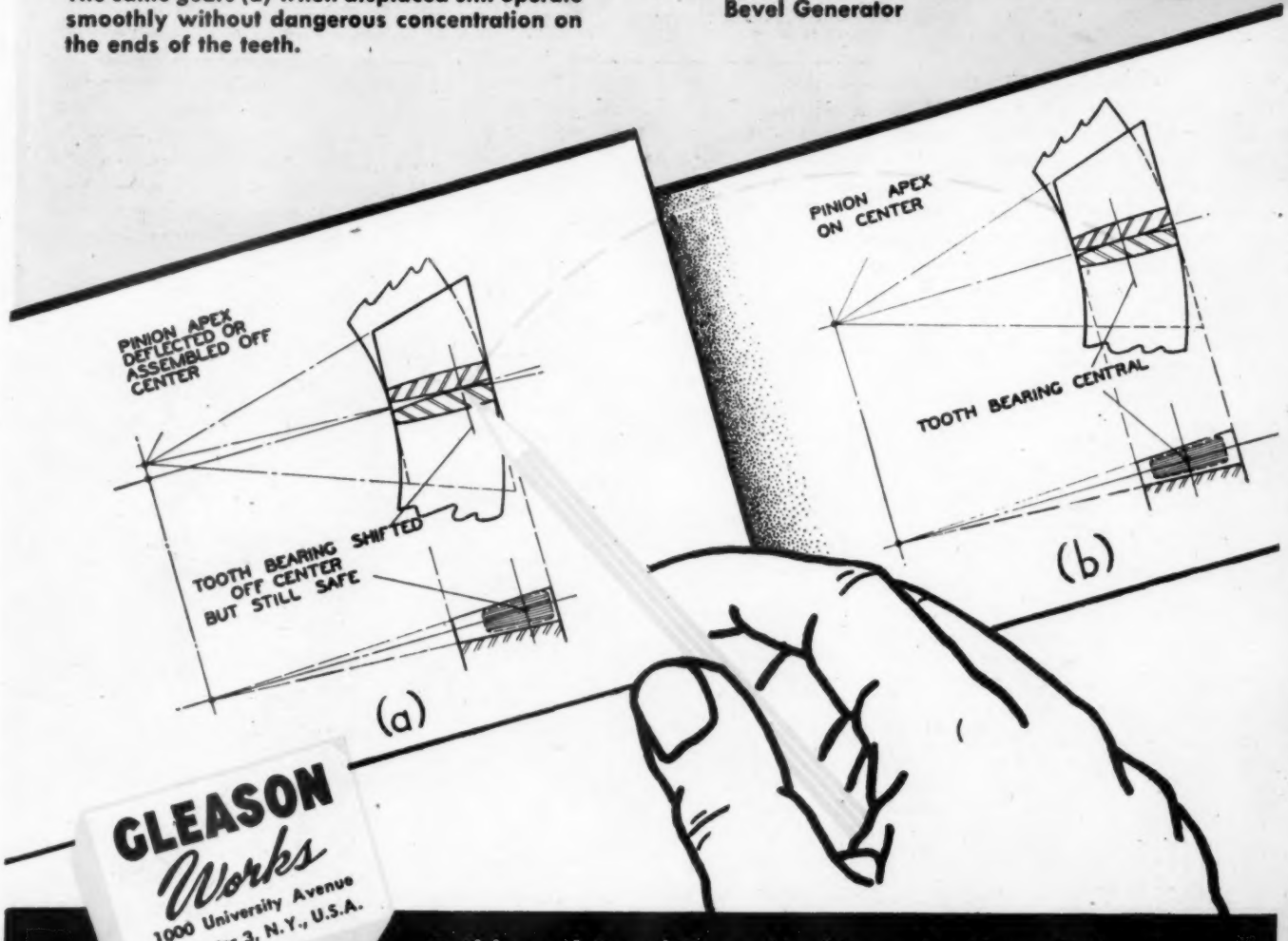
Why are they preferred? . . . because the ends of the teeth are relieved, allowing for slight deflections in operation without dangerous concentration of the loads at the ends of the teeth. This also makes assembling simpler and provides a definite bearing for smoother, quieter operation.

The usual operating position (b) for generated straight bevel gears is with the bearing centrally located.

The same gears (a) when displaced still operate smoothly without dangerous concentration on the ends of the teeth.



Gleason 12" B Straight Bevel Generator


PINION APEX DEFLECTED OR ASSEMBLED OFF CENTER
TOOTH BEARING SHIFTED OFF CENTER BUT STILL SAFE
(a)
PINION APEX ON CENTER
TOOTH BEARING CENTRAL
(b)

GLEASON Works
1000 University Avenue
Rochester 3, N.Y., U.S.A.

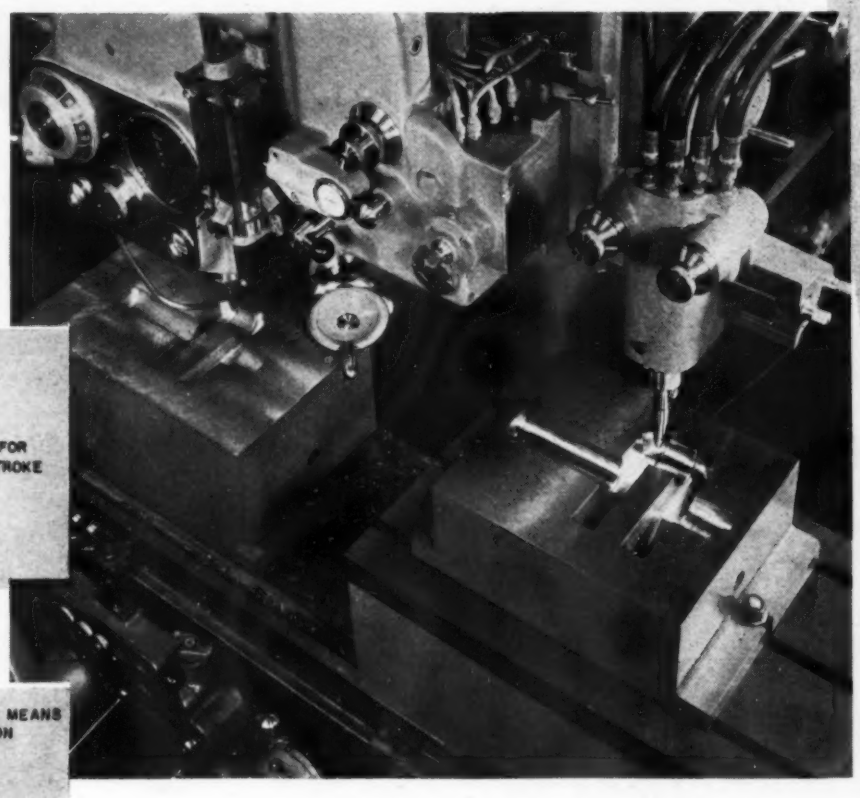
Builders of Bevel Gear Machinery for Over Eighty Years

TRANSFER OF SKILL:

There seems to be growing interest in methods by which machine tools can be made to reproduce intricate shapes through template and other pattern and model control. In part this is due to increasing use of dies. Also, it is due to increasing use of highly accurate mathematical curves on parts used in such devices as prime movers, process control apparatus, instruments, etc. (Steel, Oct 7, '46)

Here are four CINCINNATI Hydro-Tel type Milling Machines, all of them good examples of "transfer of skill"... i.e., the machine supplements the skill of the operator to such an extent that it requires him only to load and unload the work after the machine has been properly set up. Once loaded, the machine goes through the milling cycle automatically with very little attention. Through the "transfer of skill," several important considerations have been accomplished. 1) Much of the uncertainty in intricate milling operations such as these is removed. 2) Production is increased while unit costs are lowered. 3) Losses because of spoilage are reduced. 4) Less concentration is necessary—a factor that greatly reduces operator fatigue. 5) Much closer accuracy can be maintained, and subsequent hand finishing of dies and molds is greatly reduced. ¶ You can profitably use CINCINNATI Hydro-Tel type Milling Machines to supplement the skill of your men who are charged with the job of milling complex Profiles and Contours. Our engineers will be glad to study your work and advise you.

CINCINNATI 16" Vertical Hydro-Tel Die-Sinking Machine is illustrated at the right. The operation consists of sinking a single-throw crankshaft die. Through the use of the Automatic Depth Control Mechanism, the complex contours of the metal master shape are accurately reproduced in the die block. Diagrams below show the automatic feed cycle. This machine may also be used for general purpose milling. Write for catalog M-1497.



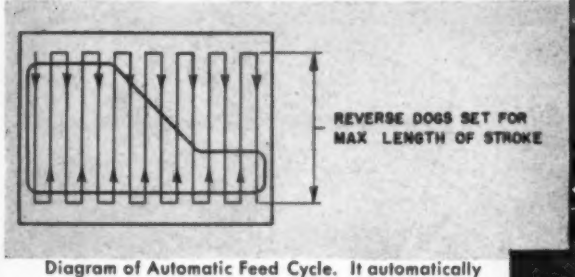
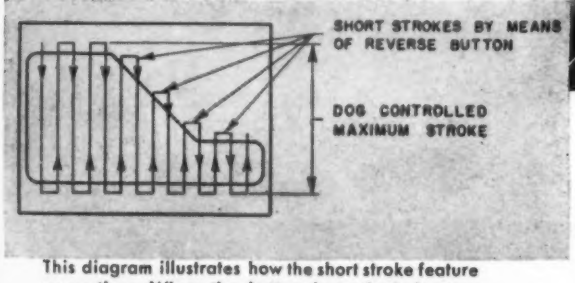


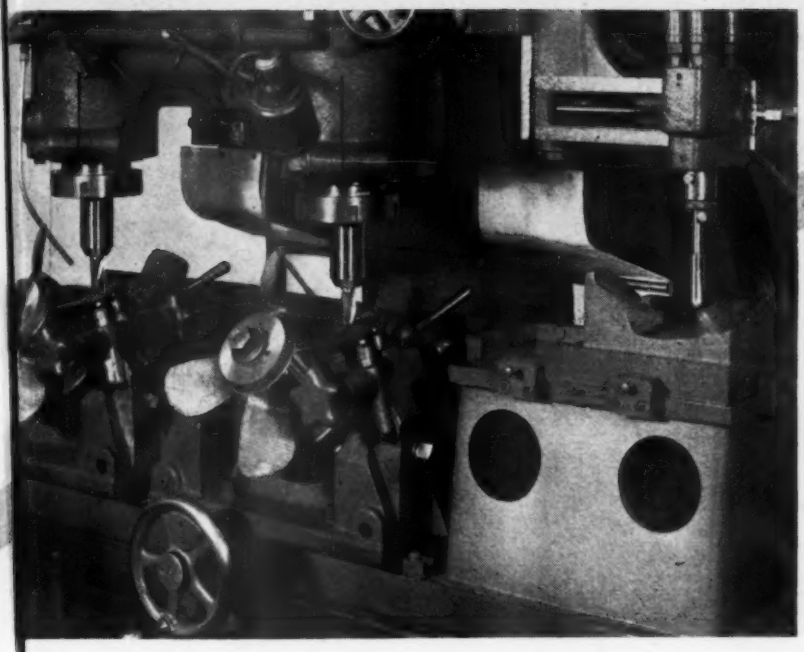
Diagram of Automatic Feed Cycle. It automatically advances the table a selected increment of feed at each reversal of the cross-slide, relieving the operator of this duty.



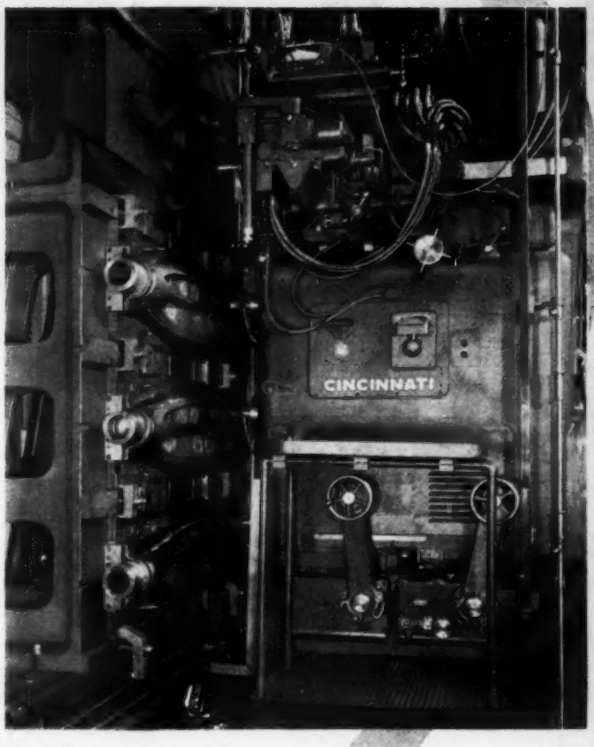
This diagram illustrates how the short stroke feature saves time. When the button is pushed, it stops cross-slide movement, pick feeds the table, and starts cross-slide movement in opposite direction.

THE CINCINNATI

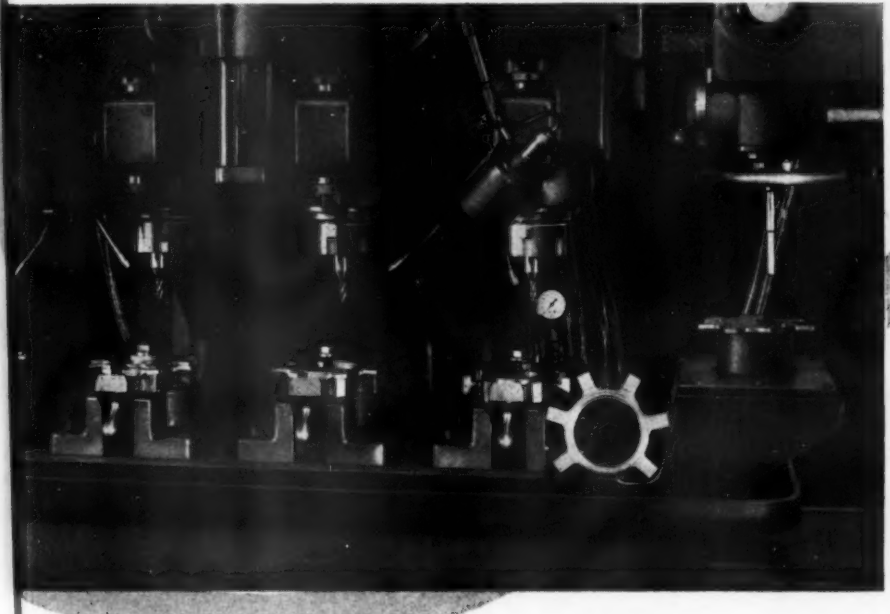
MILLING MACHINES



Above: CINCINNATI 28" Vertical Hydro-Tel Milling Machine, with Automatic Depth Control Unit (Die-Sinking Equipment), and Two Spindle Vertical Head. Here the machine is used not for die-sinking, but for a production job of milling the surfaces of propeller blades. More information on machines of this type may be obtained by writing for catalog M-1284.



Below: As its name implies, the Four Spindle 360° Automatic Profiling Machine has four spindles, constituting four work stations, any one or all of which may be tooled up for profile milling cuts under the guidance of the master control unit at the right. In this illustration, the complex outline of aircraft engine knuckle pin locking plates is completely profile milled—automatically—four at a time—within limits of ± .003". Complete data on these machines is contained in catalog M-1215.



Above: Three aircraft propeller blades are milled at the same time on this CINCINNATI 36" Horizontal Hydro-Tel Milling Machine equipped with 360° Profiling Mechanism and Automatic Depth Control Unit. The skill required to produce the profile of the parts and the complex contour of the blade surface is completely taken over by the machine. Description and engineering specifications of the 36" Horizontal Hydro-Tel may be obtained by writing for catalog M-1285-1.

CINCINNATI

MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

No.6. The Puzzle of the

Counterfeit Coin

Here are 9 coins and a scale. Eight of the coins are of equal weight — the ninth is counterfeit, weighs less.

The problem: What's the least number of weighings necessary to isolate the counterfeit coin?*

Tricky, this one, but very apropos. For it's quite a trick today to solve some metal turning problems . . . to remove metal more quickly, more economically, in the least number of operations.

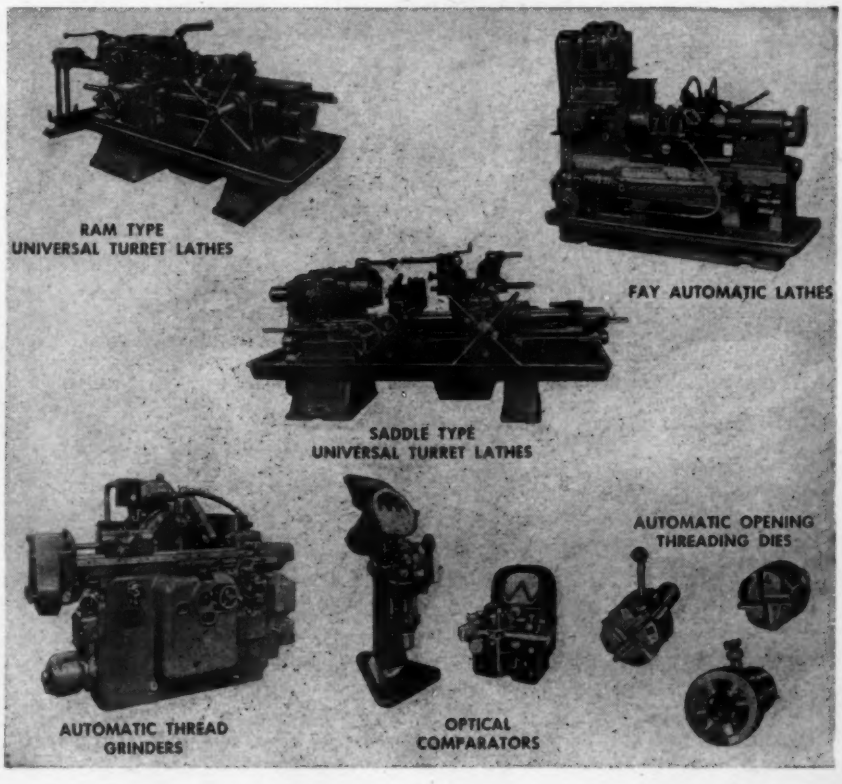
The chances are that turning accounts for 25 per cent or more of all machining time in your plant.

There are cases in our files of savings of hundreds of dollars a month in the manufacture of a single part by the use of Jones & Lamson machines. Our machines are designed specifically for the most efficient use of carbide tools which can remove metal 200 to 500 per cent faster. We have solved many tough cost problems. Solving them is our business.

Be skeptical of the production efficiency of all metal turning equipment in your plant.

Telephone or write for a Jones & Lamson engineer who will be glad to consult with you on all phases of your metal turning problems.

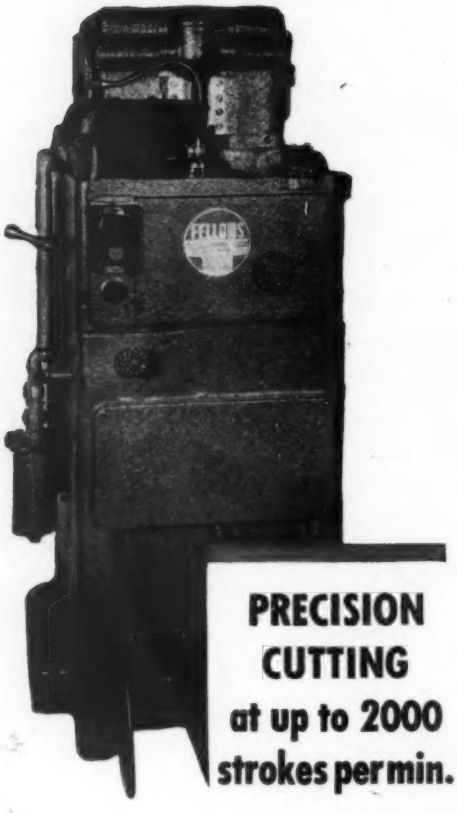
* The answer is 2.



JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies.

Putting NEW *Precision* into



PRECISION CUTTING at up to 2000 strokes per min.

No. 3 Fine Pitch Gear Shaper can be tooled with cutters up to 100 pitch and finer, for the high-speed production of gears and pinions up to 3 inches diameter and ¾ inch face width.

Thin blanks can be ganged on arbors, and other expedients used, by which production rates top even that of sub-press dies. In precision, the Gear Shaper is in a class by itself.

HIGH-SPEED FINISHING on No. 4 Shaving Machine

For work to 48—or in some cases 64—pitch, shaving has become an economically desirable finishing operation where extreme accuracy is demanded.

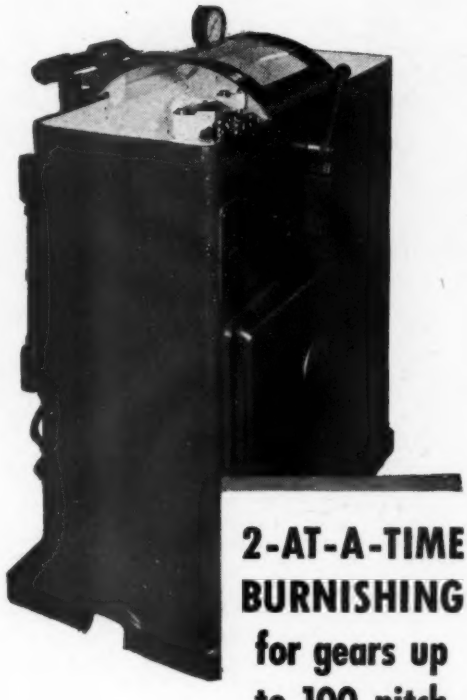
The Fellows Fine Pitch Shaving Machine shown here is an ideal running mate for the small Gear Shaper. Built with automatic controls for any time cycle required by your work, its production rate is of a high order. Well worth investigating!

● **GOVERNMENT SURPLUS MACHINE TOOLS:** We are licensed under the WAR ASSETS ADMINISTRATION to act as dealers in the disposal of Government Surplus Machinery. Those interested in obtaining such machinery should contact our Main Office, Springfield, Vt.; or our offices in Detroit, Mich. and Chicago, Ill.

THE FELLOWS METHOD... MACHINES AND TOOLS FOR

SMALL FINE-PITCH GEAR PRODUCTION

Modern precision gears of high involute accuracy—as fine as 64, 100 or even 200 pitch—can contribute substantially increased serviceability to the improved product of which they become a part. Quieter operation, extra precision in geared movements, and longer wear can be catalogued as features of which your sales department will make full capital.



2-AT-A-TIME BURNISHING for gears up to 100 pitch

For extremely fine pitch gears to be used in their soft state, and particularly those of non-ferrous metal, this high production No. 4B Burnishing Machine performs advantageously.

Semi-automatic functioning speeds the work, and keeps your operator busy loading and unloading the dual spindles.

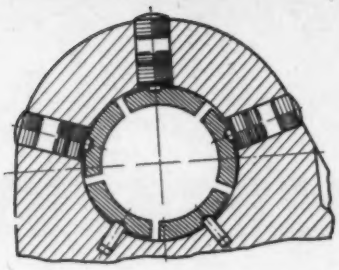
From an engineering and shop point of view, the trio of Fellows Fine Pitch Gear Production Machines shown here have every qualification for (1) cutting production costs, (2) setting new standards of accuracy, and (3) standing up to long years of service.

Descriptive circulars on one, two or all three machines are yours for the asking. Write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit—or 640 West Town Office Building, Chicago.

Fellows

FOR ALL OPERATIONS FROM BLANK TO FINISHED GEAR

In the illustration above, the operator is grinding a milling machine spindle—where extreme accuracy and high finish are imperative. The machine is a CINCINNATI FILMATIC 10" Plain Hydraulic Grinder.



FILMATIC Grinding Wheel Spindle Bearings, an exclusive feature, help to produce exceptionally fine finishes and eliminate bearing maintenance. Self-adjusting. No discernible spindle flutter. Over several years CINCINNATI Grinding Machines, equipped with FILMATIC Spindle Bearings, never have had down time charged against them because of grinding wheel spindle bearing failure.

FILMATIC

CINCINNATI FILMATIC 10" Plain Hydraulic Grinder. Catalog G-490-2 contains complete specifications.

Shown on these pages are some of the reasons why unusually high quality finishes and close limits of accuracy are accomplished easily and quickly on CINCINNATI FILMATIC Plain Hydraulic Grinding Machines. ¶ Perhaps the most outstanding feature is FILMATIC Spindle Bearings—exclusive in all CINCINNATI Grinding Machines. Of course, the other features illustrated contribute their share, and in addition, CINCINNATI FILMATIC Plain Hydraulic Grinders have: a) Infinitely variable table reverse speeds 3" to 240" per minute. b) Exceptionally accurate movement of wheelhead cross-slide. c) Single lever start-stop of coolant flow, work rotation, and table traverse. d) Independent right- and left-hand tarry adjustments. e) Screw and lever type footstock. ¶ CINCINNATI FILMATIC Plain Hydraulic Grinders are available in 4", 6", 10"-L, 10" and 14"-L sizes. Our engineers will be glad to talk to you about your grinding requirements.

CINCINNATI

CENTER TYPE GRINDING MACHINES

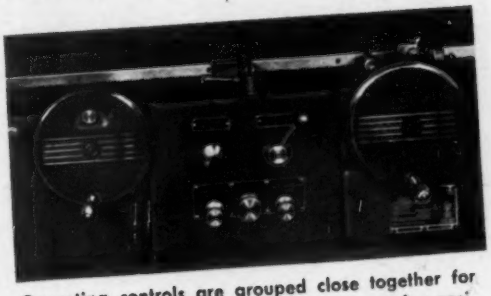
Fussy Jobs

like SPINDLES and ARBORS

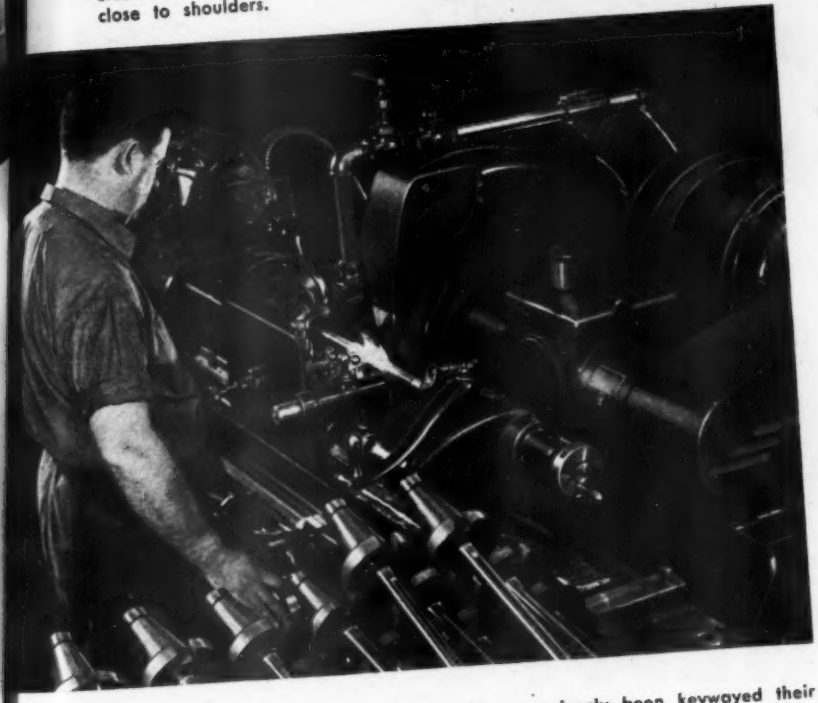
ARE GROUND ON CINCINNATI FILMATIC GRINDERS

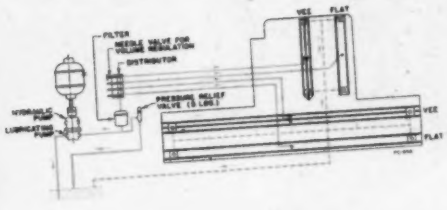
Adjustable Reversing Dogs on the front of the table control table reciprocation from $\frac{3}{32}$" to full table stroke. Accuracy of table reversal with power traverse engaged, within .004". This permits power table traverse to be used when grinding close to shoulders.

Cross Traverse Handwheel. Dial graduations on the hub are convenient for multiple diameter work. A large instruction plate indicates reductions in work diameter for various increments of infeed movement. Hydraulic backlash eliminating device, incorporated in cross feed unit, assures accurate sizing adjustment.



Operating controls are grouped close together for efficient manipulation. All controls are safe, positive, accurate and responsive. Built-in electrical control buttons—headstock and coolant, and start-stop—are located in a panel a few inches to the left of the above controls. The operator need not move from his normal working position to reach any control. Unit type construction permits removal of any control unit independently of the others.





Automatic Filtered Pressure Lubrication for table ways and cross ways assures greater accuracy and finer finishes, helps keep down maintenance costs, and increases useful life span of the machine. Telescopic guards at ends of table protect ways.

Finish grinding milling machine arbors which have previously been keywayed their entire length. Requirements are close limits of accuracy and high-grade finishes on a production basis. The machine is a CINCINNATI FILMATIC 10" Plain Hydraulic Grinder.

CINCINNATI

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Gives

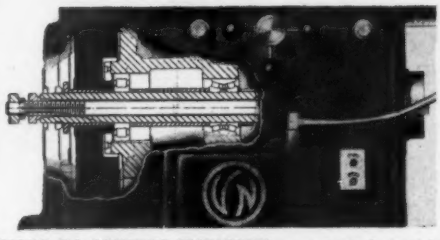
VAN NORMAN

No. 2 HEAVY

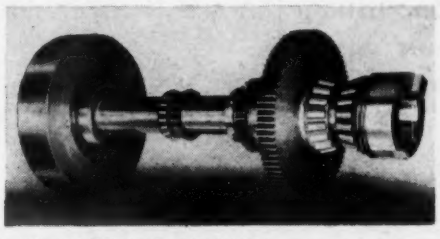
Horizontal Milling Machine

You 4 Outstanding Features

That Improve Cutability, Simplify Operation, Increase Production

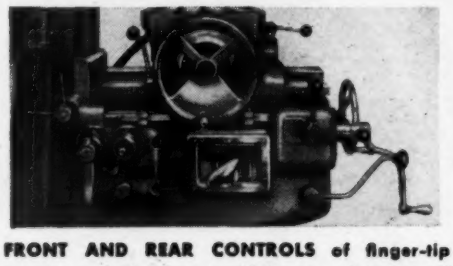


BUILT-IN SPINDLE FLYWHEEL, mounted inside the column, assures uniform uninterrupted transmission of power to cutter. The heavy flywheel increases and improves cutability . . . permits smoother finish of work surface.



5 ANTI-FRICTION BEARINGS support the large diameter alloy steel spindle. They maintain accuracy by assuring maximum spindle strength and rigidity under every type of cut.

EASE OF SPINDLE CONTROL is assured with single lever feed selector and convenient spindle reverse. Spindle clutch lever for starting and stopping spindle is quickly adjusted to most convenient operating position.



FRONT AND REAR CONTROLS of finger-tip power and six-way rapid traverse levers and manual adjustments simplify operation . . . reduce worker fatigue. Directional power controls provide maximum work and operator safety.

Look into the Van Norman No. 2 Heavy for general purpose and production milling. This heavy, rugged, highly efficient machine will give maximum quality service, increase production, lower costs on a wide variety of applications. Available with plain or universal saddle. Write for information.

VAN NORMAN COMPANY
SPRINGFIELD 7, MASSACHUSETTS

The LANDMACO

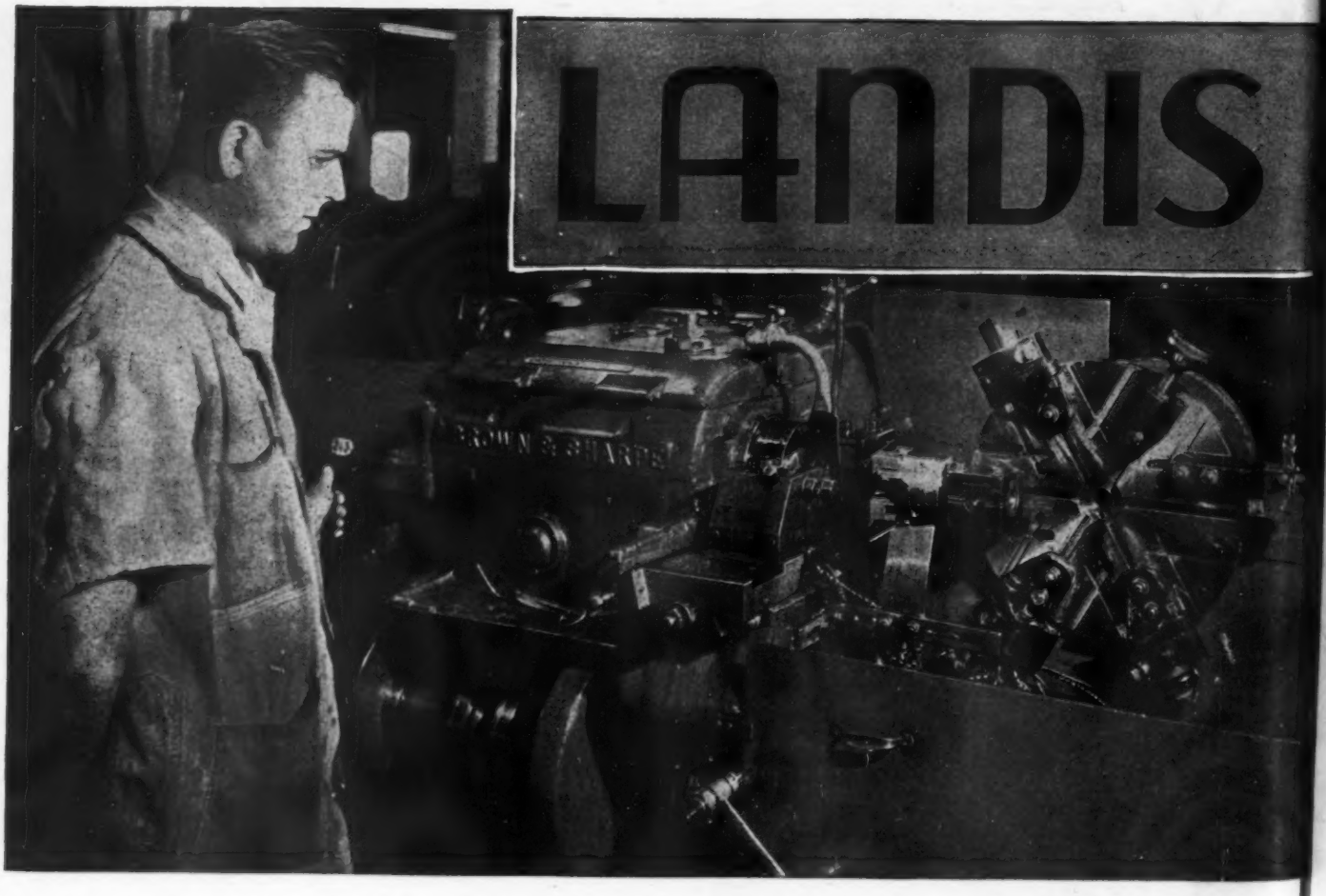
THREADING MACHINES AND LANDMATIC HEADS

Lead The Way In Production

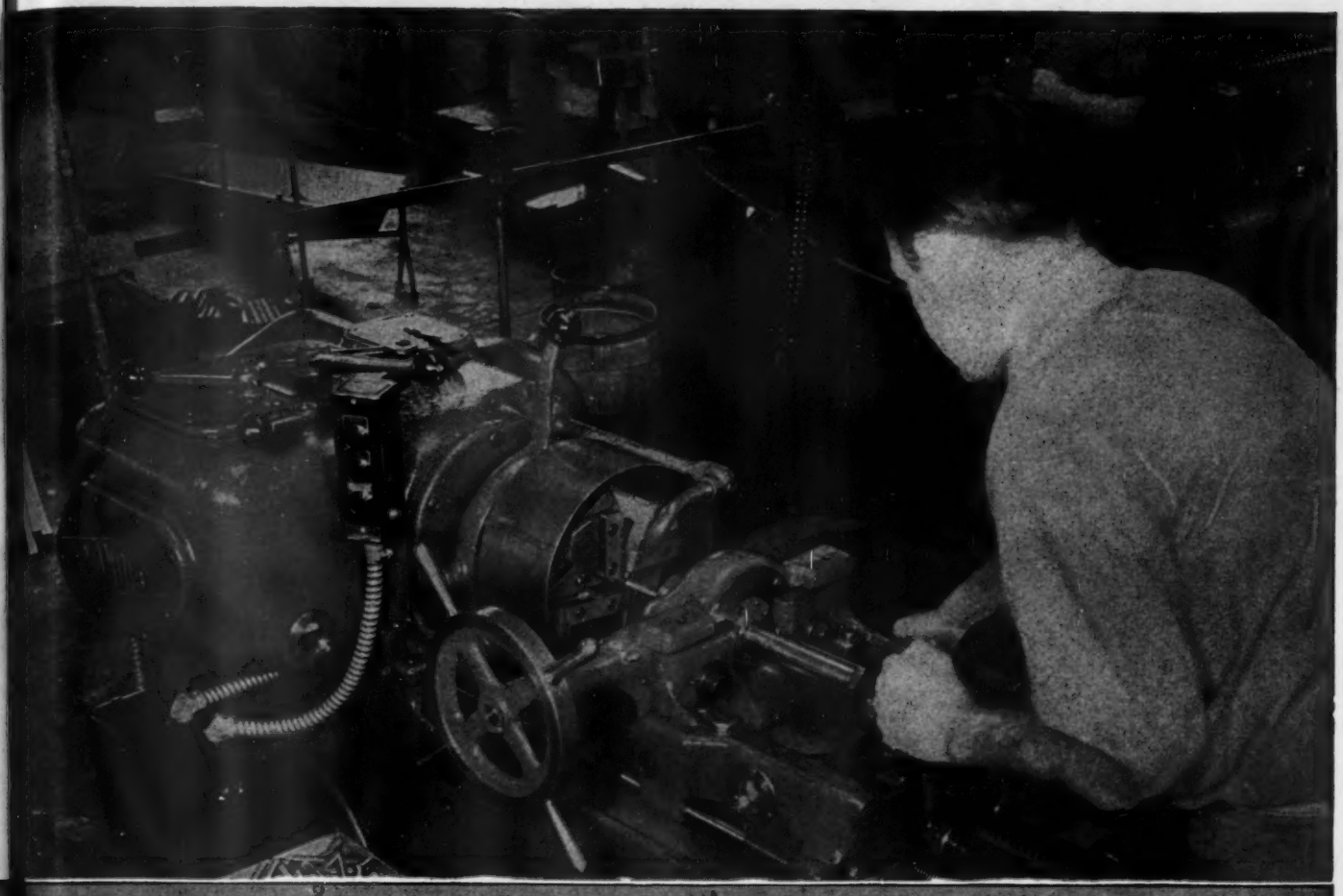
Landis Threading Equipment has been called upon time after time to handle Threading jobs that, not so many years ago, would have been impossible.

New equipment, new products, new uses now bring new Threading Problems. Landis Equipment has proven its capacity to handle the unusual—as well as the usual. It will equally handle your Threading needs in the days to come.

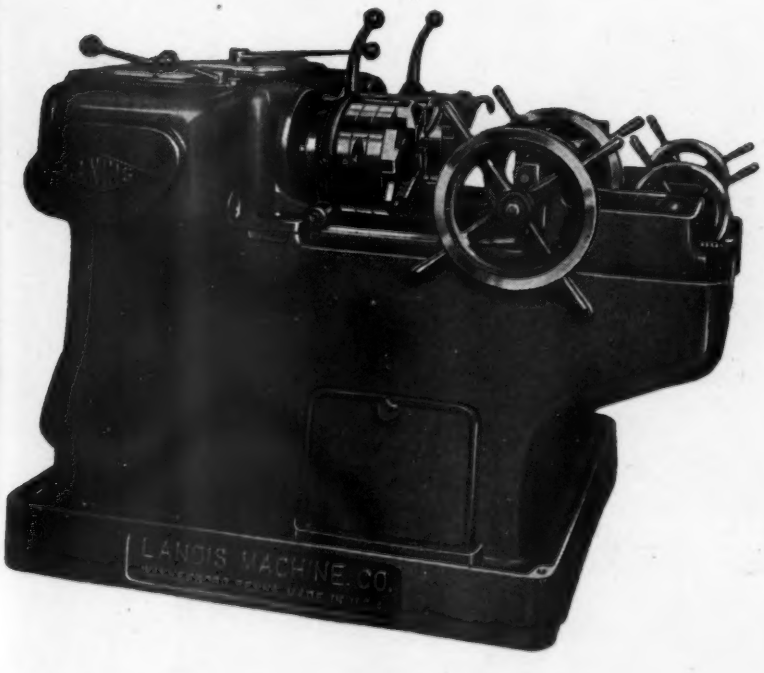
Write for Bulletin No. H-75



THREAD CUTTING MACHINES • DIE HEADS • COLLAPSIBLE TAPS • THREAD GRINDERS



MACHINE CO. WAYNESBORO PENNA. U.S.A.



Above: The Landmaco Machine illustrated, equipped with the collet type carriage front is threading studs made from alloy steel to class 3 specifications. Eight hundred to one thousand pieces are threaded per grind of the chasers.

Left: The 7/8" Landmatic Head illustrated is producing alloy steel plugs 1½" diameter, 12 threads per inch to class 3 specifications. An average of 1500 plugs are threaded per grind of the chasers.

Sure it's big work for a 20-inch lathe but she does a swell job..."

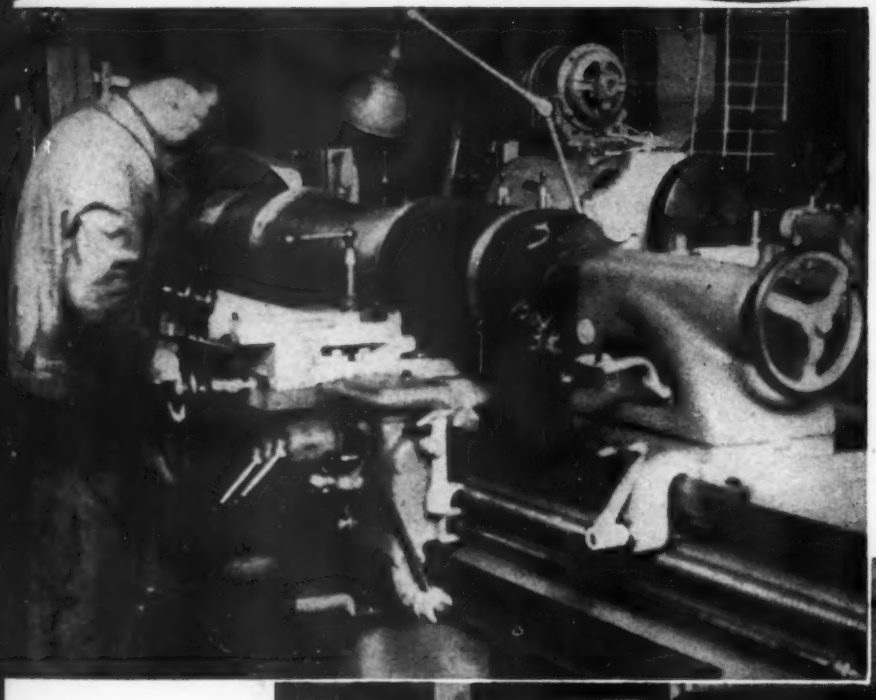
In these few words t superintendent of prominent railroad sho expressed approval of hi "AMERICAN" Pace maker Lathe.

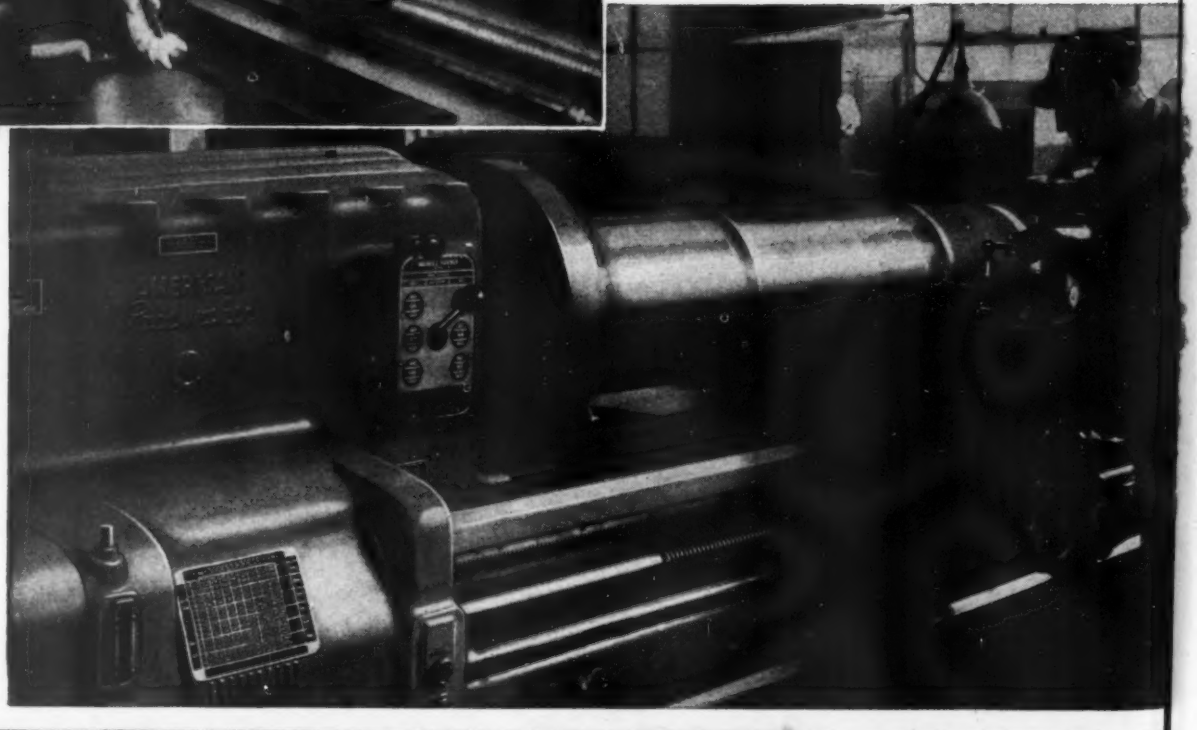
He particularly likes—

1. The power and speeds fo using cemented carbide too to their limit.

2. The ruggedness and stamin which permit large work t be done without chatter.

3. The ease and convenience c control which saves operati time and encourages opera to use correct speeds feeds.





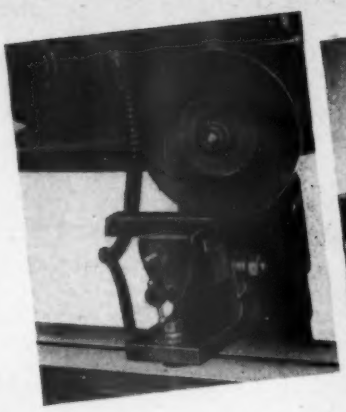
"American" Pace-maker Lathes are favorites in many of our best railroad shops. They are de-pendable, low-cost producers. Send for descriptive bulletin No. 16.

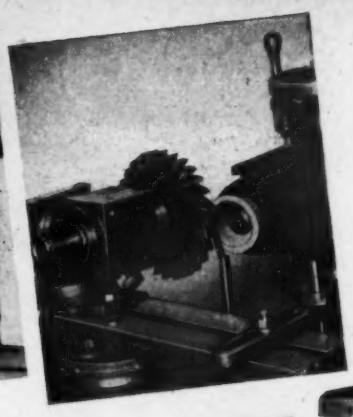
"American" Hole Wizard Radial Drills are also doing a fine job for the railroads.

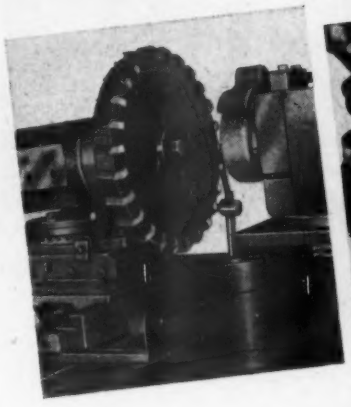
THE AMERICAN TOOL WORKS CO.

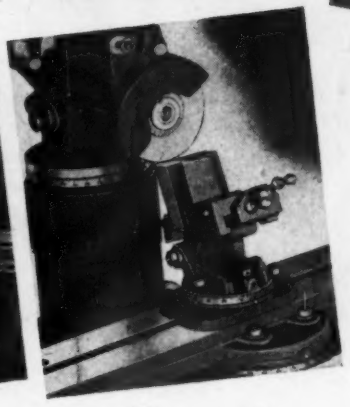
Cincinnati, Ohio, U. S. A.

Universal Radial Drill









TOOL JOBS COST LESS ON A NO. 12

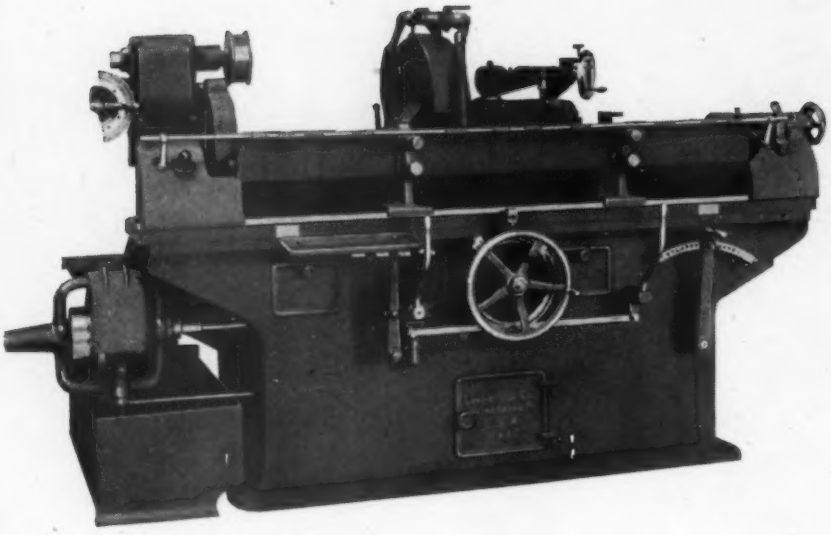
UNIVERSAL CUTTER AND TOOL GRINDER

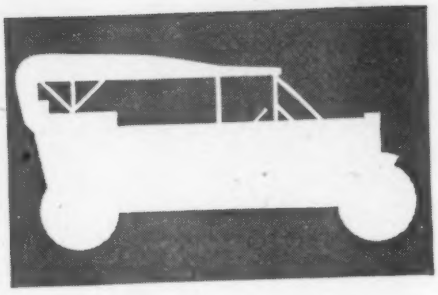
For a wide range of toolroom work here's a grinder with the universal utility and long-life precision which will mean savings for your operation. It's a rugged, dependable machine — a development of years of tool grinding experience. It will do more jobs, better — and at less cost. That's why the COVEL No. 12 is in more toolrooms today than ever before — why it will pay you to see how the No. 12 can help you lower toolroom costs. Write today.

This bulletin No. A-246 gives complete details on the No. 12 and attachments. Ask for it today or see your nearest COVEL dealer.

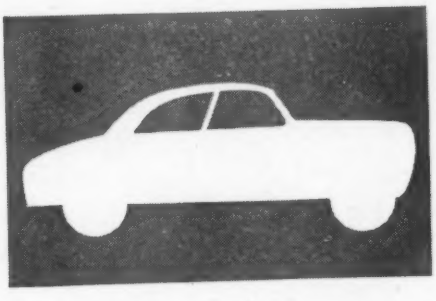
COVEL MANUFACTURING CO.
BENTON HARBOR, MICHIGAN, U.S.A.

COVEL
INDUSTRIAL GRINDERS





How LANDIS TOOL Improved Crankshaft Grinding



comparison

GRINDING LINE BEARINGS

Production 3.2

Number of Grinding Operations . . . 20

Accuracy . .002″ on dia.

Progress in internal combustion engines has been paralleled by Landis Tool Company improvements in crankshaft production that lower costs, improve finishes, give better bearing alignment and reduce diameter variation.

Large diameter wheels, hydraulic feeds, and the simultaneous grinding of multiple diameters are among the more important Landis Tool automotive crankshaft grinding developments.

to Give Better Engines at Lower Cost

Production 32

Number of Grinding Operations 1

Accuracy . .0005″ on dia.

By elimination of the semi-finishing operation and other handling, production increased tenfold and unit cost decreased sharply.

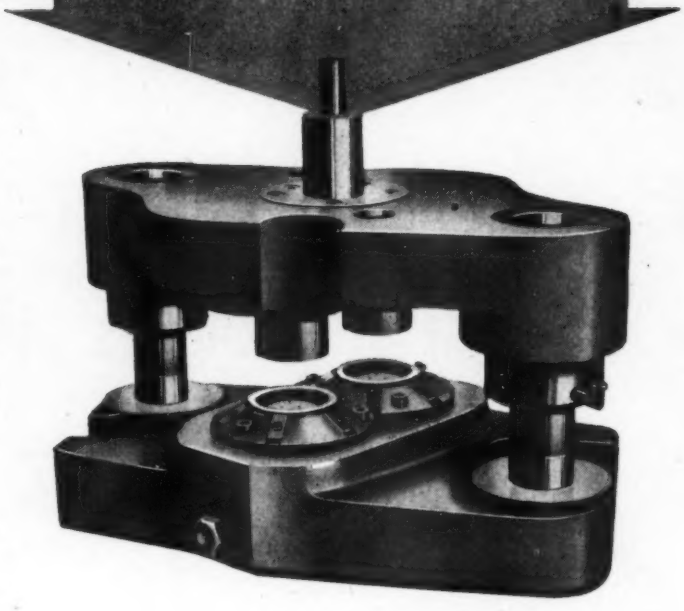
Whatever your grinding need, you will find a Landis Tool precision grinder with latest features for high production and close accuracy.

LANDIS TOOL *Precision Grinders*

LANDIS TOOL COMPANY
WAYNESBORO, PENNA.

PRESS "DOWN-TIME" ISN'T PROFITABLE

You Can Reduce It *Tremendously* with CARBIDE DIES



YOU don't make money when your presses are down for replacement of dies. It is in the reduction of this down-time and reduction of die maintenance that the real economy of carbide dies is best realized . . . Carbide dies seldom require regrinding. Production runs are greatly increased and die maintenance greatly decreased.

The life of carbide dies far exceeds that of similar steel dies—if they are correctly engineered and built. This requires a specialized knowledge of proper application of carbides . . . and accurate manufacturing methods.

Lincoln Park has had more than 10 years' experience in precision applications of tungsten carbide. Here, too, are production facilities unexcelled for this type of die work and practical knowledge gained through building a number of different types of carbide dies which are being used successfully today.

Blanking and piercing dies for long production runs are ideal for carbide applications. A review of your present die requirements will undoubtedly show where carbide dies can offer you exceptional efficiency and economy. Let us submit quotations.

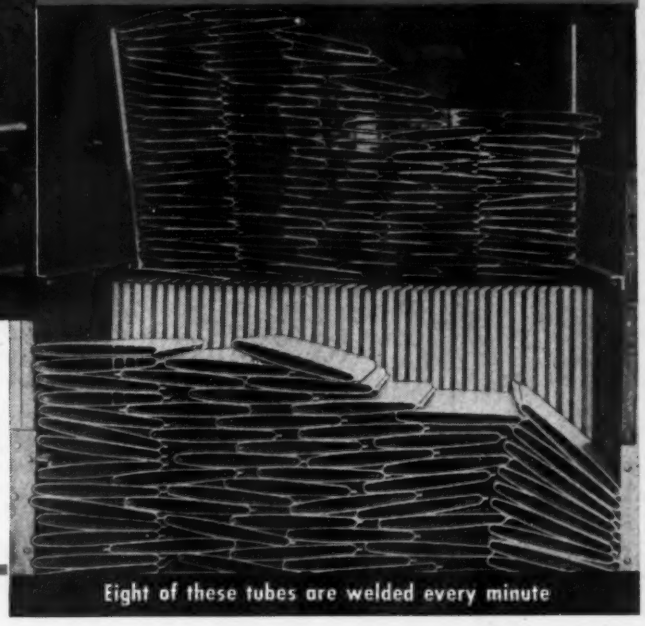
Lincoln Park **INDUSTRIES, INC.**

1723 FERRIS AVENUE • DETROIT 25, MICHIGAN

Welding tube sections at the Reznor plant

1500%

INCREASE in OUTPUT



Eight of these tubes are welded every minute

. . . made possible by electronically controlled resistance welding . . .

Heat-exchanger tubes are now produced by the Reznor Manufacturing Co., Mercer, Pa., at *16 times* the former rate, using seam welding.

While one operator could produce only *30* tubes an hour by gas welding, he can now complete *480*—or a total of 45,000 inches of weld.

This is just one striking example of the boosts in output possible with seam welding.

Why ELECTRONIC Control Was Chosen

Basically a fast process, seam welding is speeded up even more by electronic control. With this type of control it is possible to interrupt the welding current consistently up to 1800 times in a *single minute.*

Equally important is the fact that electronic seam-welder control, with its synchronous-precision timing, helps assure high-quality welds.

Electronic control is quiet operating, too. The welding current is controlled by noiseless electronic tubes. And because there are no contacts to replace, maintenance cost is low.

If you'd like more information about electronic seam-welder control, ask our local office for a copy of Bulletin GEA-4220. Our engineers will be glad to help you with your application. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

REDUCED KVA DEMAND

This electronic seam-welder panel used in the Reznor plant offers an additional advantage—it is designed for use with series capacitors to provide power-factor correction. This combination makes possible a material reduction in demand on the power supply—an important saving in all industries.

G-E RESISTANCE WELDING CONTROL

GENERAL ELECTRIC

ONE LEVER CONTROL...
NORTON GRINDERS
and Lappers

Just One of the Reasons for the Popularity of

NORTON SEMIAUTOMATIC MACHINES

4" – 6" – 10"

RUGGED, fast, accurate — applicable to small lot production—that's the NORTON Semiautomatic Grinder. And its design features eliminate both time-consuming manual feeding and the need for high operating skill. Place the work between centers—*move one lever*—the machine makes a complete grinding cycle (electrically or manually controlled) and stops ready for reloading.

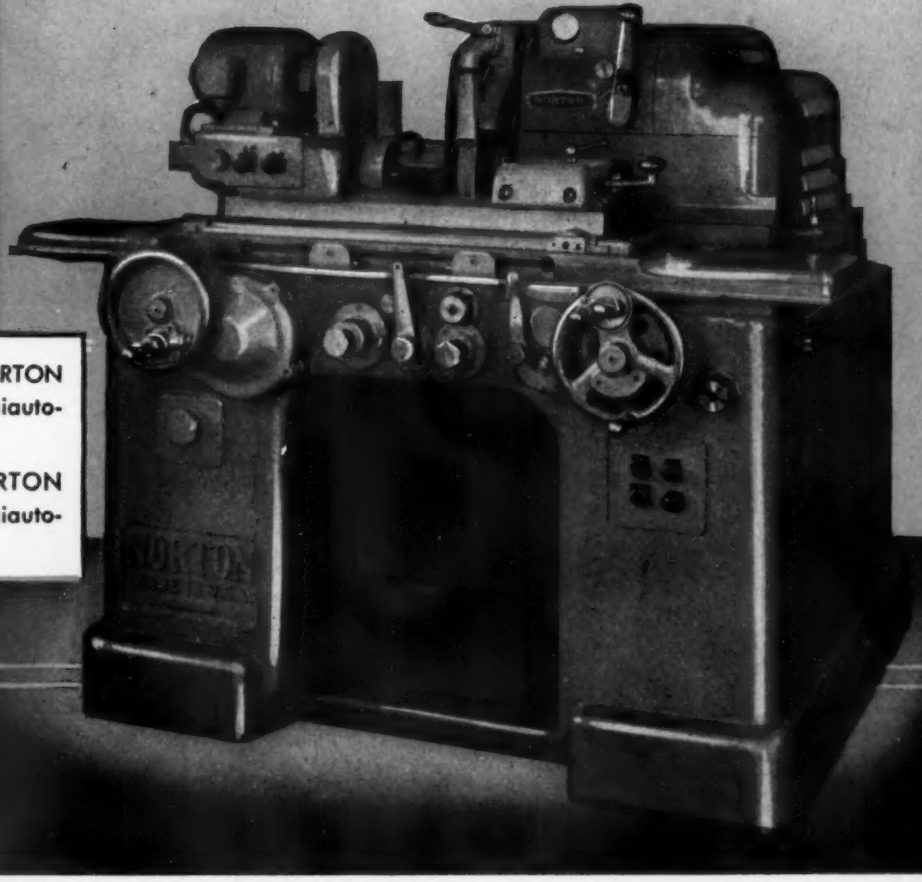
Many combinations of equipment are available and specialized work fixtures can be supplied to meet your production demands.

Write for new catalogs giving detailed information on the NORTON Semiautomatics.

NORTON COMPANY, WORCESTER 6, MASS.

Distributors in All Principal Cities

M-523



RIGHT: The NORTON 4" Type C Semiautomatic Grinder.

LEFT: The NORTON 6" Type C Semiautomatic Grinder.

"Brother, they're TOPS in for Non Ferrous Metals!"

in Taps

MORSE SPIRAL FLUTED TAPS

are Specially Designed to Produce Clean, Accurate Threads in Aluminum, Magnesium, Zinc, Copper, Brass, and Stringy Metals

Conventional taps are ineffectual in die cast metals and metals of a stringy nature because they leave torn, rough, and damaged threads. *That's why Morse designed its Spiral Fluted Tap.* This tap is made specifically to produce sharp, clean threads in aluminum, magnesium, copper, brass, zinc, etc. . . . threads which have *lasting strength* and permanent *holding power.*

The Morse Spiral Fluted Tap is *free cutting* and, as it works into the metal, it automatically clears the chips from the hole, thereby eliminating clogged grooves.

Remember that, besides Special Purpose Taps, the wide Morse Line can provide you with a tap, standard or special, to suit precisely, for maximum effectiveness, whatever metal your production specifications call for — from magnesium to stainless steel. Morse engineers and your Morse distributor are ready to help you choose the *right* tap for *your* job.

Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manufacture

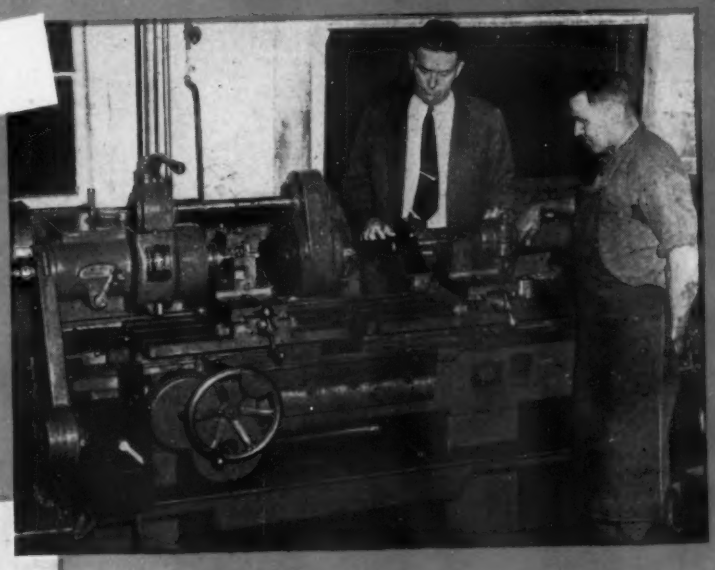
MORSE TWIST DRILL & MACHINE COMPANY

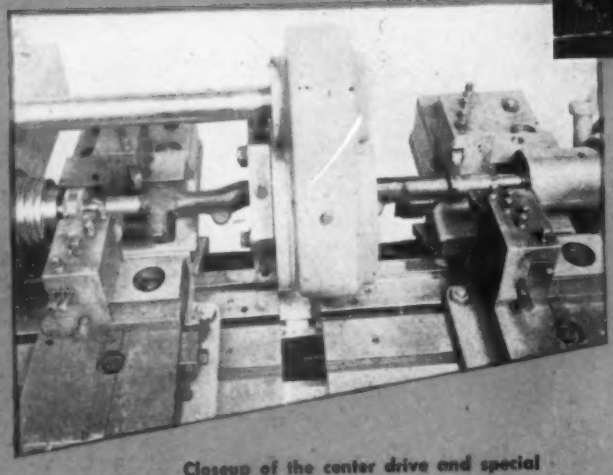
The Original Manufacturer of Twist Drills

NEW BEDFORD, MASSACHUSETTS

NEW YORK STORE: 130 LAFAYETTE ST. • CHICAGO STORE: 570 WEST RANDOLPH ST. • SAN FRANCISCO STORE: 1180 FOLSOM ST.

BOSTON





Closeup of the center drive and special front and rear tool blocks installed on a LeBlond Special Purpose Lathe for the pick shaft job.

ALBERT M. STEDFAST,
Stedfast & Roulston, Inc.,
Boston, Mass.

"Since the days of our well-remembered 'tea party', Bostonians have seen to it that they get what they need, whether it's tea or machine tools. We shoulder the responsibility for equipping manufacturing plants all over the world and our mechanical men, long trained in the New England tradition of quality and precision, select tools with a critical eye. Machinery you ship into the 'Hub' has to be right for the job.

"Take this big textile machinery manufacturer I visited the other day. They handle a tricky job of turning and facing pick shafts. On their LeBlond Special Purpose Lathe, equipped with center drive, both ends of these shafts are turned, faced, and filleted, simultaneously. This lathe is giving them dimensional uniformity at a cost that has these people well satisfied. It's an all-around nice piece of special tool work."

These LeBlond Agents and many others . . . one of them near you . . . know metal turning as few men know it. Since they offer the largest line of lathes available from one manufacturer, their unbiased advice on the selection of a lathe for any specific use can be relied upon.

Industry's Story in...

BUFFALO

R. L. CRANE,
R. L. Crane Machinery Co.,
Buffalo, N. Y.

"Flying, rolling, or sailing, Buffalo is a transportation town. It's surprising how many of the things we make are designed to go somewhere, carry something somewhere, or just keep on the move. Naturally, a lot of automobiles list Buffalo as their home port. And, naturally, Buffalo auto builders see to it that their plants operate machine tools that keep cars rolling down the line. Here's proof of that... this picture of one of several LeBlond DM Automatic Crankshaft Lathes now operating in a big Buffalo car plant. They've found that LeBlonds keep the pace up and trouble down."

"What does economy mean to a gold miner? Plenty! Here's a story with something of the romance of the old Alaska days, plus plenty of good common sense fact of today. Years ago, up in Fairbanks, Alaska, they designed quite a drill for test boring gold-bearing earth. This machine was so successful at that, and a lot of other uses, that the company now making them, the Fairbanks Drill Co., here in Seattle, is plenty busy. They needed a lathe with a long bed for turning pipe and drill stems and, for several years, tried to find a good used one. However, as soon as we told them about Regals, they realized that they could have a brand new Regal for very little more than the cost of a lot of used machines. Result... this 19" x 18' 0" Regal moved in and Fairbanks is fixed for low cost precision turning for a long time to come."

L. J. KINNANE,
Kinnane Machinery Co.,
Seattle, Wash.

SEATTLE

The R. K. LeBlond MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

NEW YORK 6, Singer Bldg., 149 Broadway, COrtland 7-6621-2-3

CHICAGO 6, 20 N. Wacker Drive, STA 5561

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

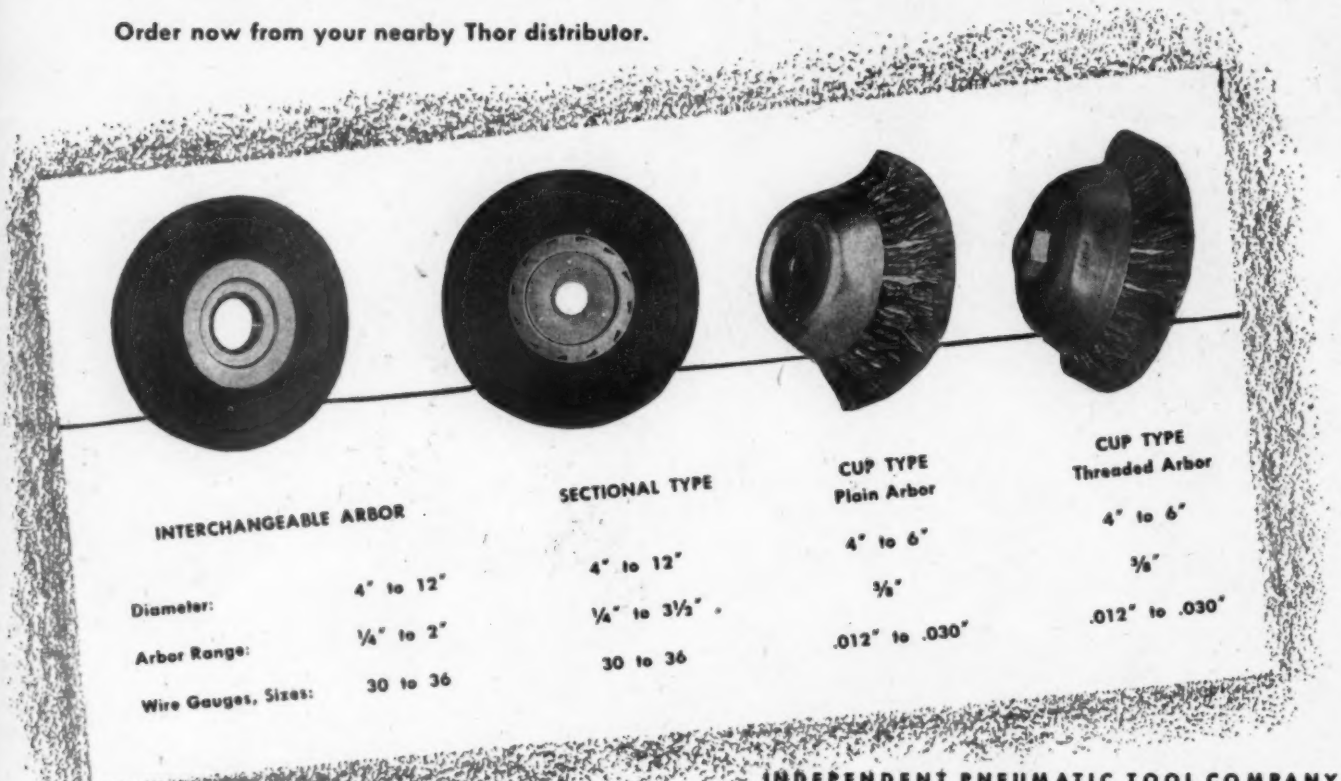
NOW... *Immediate Delivery!*

Thor WIRE WHEEL BRUSHES

from Distributors Stocks . . .

Now you can get immediate delivery of sturdy, long-life Thor wire-wheel brushes in most popular styles and sizes from your nearby Thor Distributor's stock. Available in a range of sizes from 4" to 12" diameter in single-unit, arbor-hole adaptor or metal-center sectional type. Brush sections are heavily filled with Double-Durable special crimp wire in gauges of 30 to 36. Constructed to resist crystallization and breakage, these modern brushes will operate efficiently on portable and stationary equipment with spindle speeds up to 6000 R.P.M.

Order now from your nearby Thor distributor.



	INTERCHANGEABLE ARBOR	SECTIONAL TYPE	CUP TYPE Plain Arbor	CUP TYPE Threaded Arbor
Diameter:	4" to 12"	4" to 12"	4" to 6"	4" to 6"
Arbor Range:	¼" to 2"	¼" to 3½"	⅝"	⅝"
Wire Gauges, Sizes:	30 to 36	30 to 36	.012" to .030"	.012" to .030"

INDEPENDENT PNEUMATIC TOOL COMPANY
600 W. Jackson Boulevard, Chicago 6, Illinois
BRANCHES IN PRINCIPAL CITIES

Thor PORTABLE POWER TOOLS

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS • MINING AND CONTRACTORS TOOLS

WANT TO DOUBLE WHEEL LIFE AND IMPROVE FINISH?

Plant after plant reports amazingly better wheel life and finish on grinding jobs after switching to Cimcool Cutting Fluid. Why? Because this revolutionary new *chemical emulsion* has an extremely low surface tension that allows grit and chips to settle out rapidly... and because Cimcool's property of *chemical lubricity* reduces friction to an absolute minimum, while cooling rapidly. Try Cimcool and you'll agree.

ALSO WITH CIMCOOL...

- Faster cooling allows faster cutting.
- Uniform work temperature increases accuracy.
- Chemical lubricity increases tool life.
- No fire hazard—No smoke—No slippery film.
- Non-irritating—Doesn't grow rancid.
- Contains long-lasting rust inhibitor.
- Covers 85% of ALL METAL WORKING JOBS.

CIMCOOL DIVISION OF
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

FINISH 15 TO 25% BETTER, WHEEL LIFE DOUBLED, says TECHNICAL PRODUCTS CO., of Hollywood, California

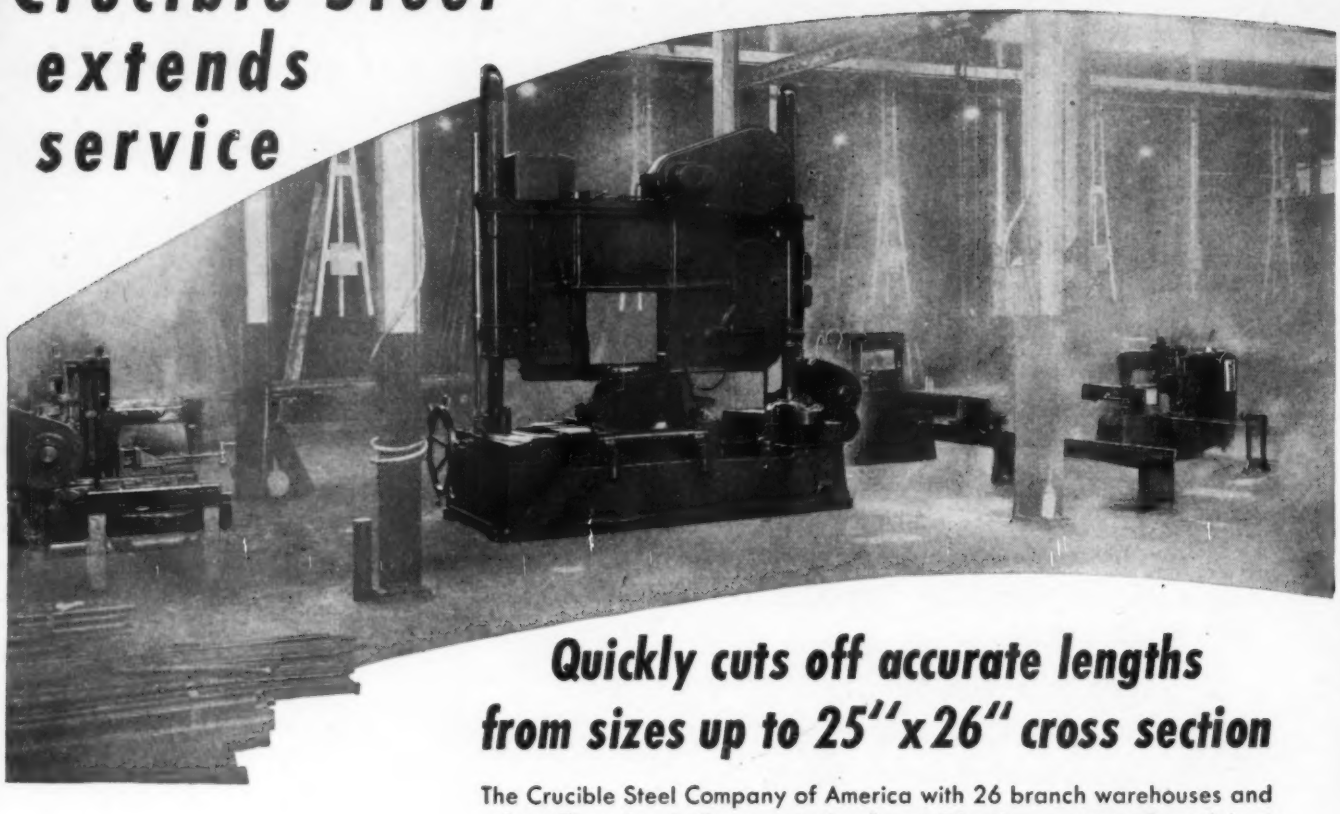
"Using the same machine, same wheel, same operator and material, we ground parts with other coolants, then changed to Cimcool. We find that our finish is from 15 to 25 percent better... and we at least double the amount of parts per wheel dress." This letter is typical of many in our files which we will gladly show you.

CIMCOOL

Reg. U. S. Pat. Office

THE MULTI-PURPOSE CUTTING FLUID

Crucible Steel extends service



Quickly cuts off accurate lengths from sizes up to 25"x26" cross section

The Crucible Steel Company of America with 26 branch warehouses and sales offices, has built a reputation for anticipating customers' needs, not only in high grade and special steels, but in service requirements as well. They were among the first to equip several of their warehouses with modern high speed MARVEL Saws (No. 6 and 9A series) in order to give fast service on either single lengths or large quantities of identical pieces, accurately cut from bars up to 10" x 10" cross section. Now in anticipation of new demands for larger sizes, they are the first steel company to install a No. 24 MARVEL Hydraulic Hack Saw in order to give fast service on orders for steels of any type *in sizes up to* 25" x 26" cross section.

This giant hack saw, which almost qualified as a "secret weapon" because it contributed so materially to our production capacity in building naval ordnance, applies an entirely new principle of reciprocation that has made "hacksawing" of large work practical for the first time.

Whatever your metal sawing problems, there is a MARVEL Saw exactly suited to your needs. A MARVEL field engineer will be glad to go over your metal sawing problems with you.

No. 24 MARVEL giant Hydraulic Hack Saw. (capacity 24" x 24"). Employs new "Roll Stroke" sawing action and trouble-free low pressure hydraulic control.

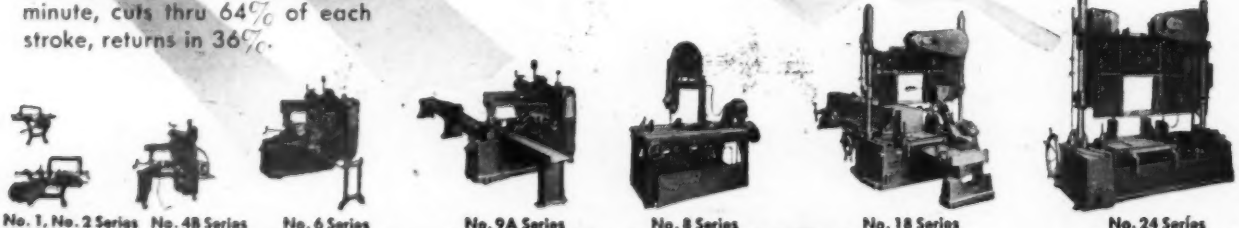
No. 9A MARVEL Production Saw (capacity 10" x 10"). Automatically feeds, measures and cuts-off identical lengths from single or nested bars with no more operator attention than an automatic screw machine.

No. 6 MARVEL Saw (capacity 6" x 6"). A high-speed, heavy-duty, all-ball-bearing saw—operates up to 149 strokes per minute, cuts thru 64% of each stroke, returns in 36%.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE, CHICAGO 39, U.S.A.



No. 1, No. 2 Series Capacity: 4"x4" Capacity: 6"x6" — No. 4B Series Capacity: 6"x6" — No. 6 Series Capacity: 6"x6" — No. 9A Series Capacity: 10"x10" — No. 8 Series Capacity: 18"x18" — No. 18 Series Capacity: 18"x18" — No. 24 Series Capacity: 24"x24"

MARVEL SAWS

Bliss' Stamping Grounds

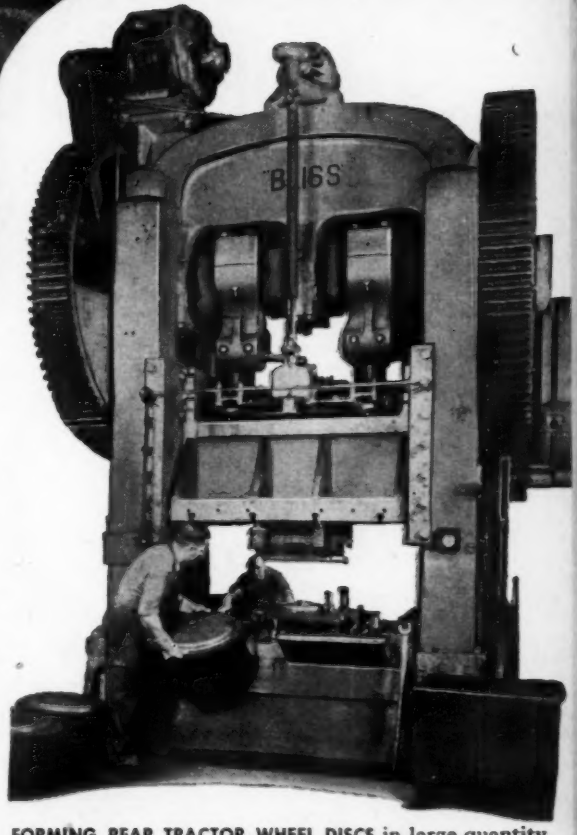
WHENEVER you see these mechanical "farm hands" silhouetting the countryside, it's a safe bet that a Bliss press helped to shape their careers.

For the tractors, cotton pickers, corn huskers, automatic milking machines and cream separators, all were "harvested" out of pressed metal, a science consistently advanced by Bliss press-making "know-how" and equipment.

We count the farm among "Bliss' Stamping Grounds" because Bliss builds the complete range of mechanical and hydraulic presses required to blank, form, draw or forge every type and size of farm equipment from large watering trucks to the endless variety of farmers' small hand tools and hardware.

Chances are, too, that the cans which bring the fruits, vegetables and milk to your kitchen were made on Bliss automatic can-making machinery.

With a background of 90 years of press-building to draw on, Bliss engineers are field-conditioned to evaluate and recommend the solution to your stamping problem. Their counsel is a very tangible "plus" when you call on Bliss.



FORMING REAR TRACTOR WHEEL DISCS in large quantity on a Bliss 450-ton double-crank press in the Oliver "Cletrac" plant.

E. W. BLISS COMPANY, DETROIT 2, MICHIGAN

WORKS AT: Brooklyn; Toledo, Cleveland, Salem, Ohio; Hastings, Mich.; Derby, England; St. Ouen sur Seine, France · SALES OFFICES: Detroit; Brooklyn; Cleveland, Dayton, Toledo, Ohio; Lansing, Mich.; Chicago; Philadelphia; Rochester; New Haven; Boston; Toronto.

BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY

STAY AHEAD WITH *Bliss*

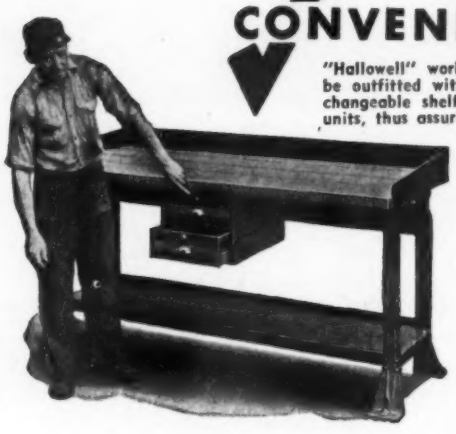
1946

CHECK THE FEATURES YOU WANT IN A WORK-BENCH .. YOU'LL FIND THEM ALL IN HALLOWELL

SHOP EQUIPMENT of STEEL

RIGHT SIZE

"Hallowell" workbenches of steel are available in five heights and widths and seven standard lengths. They can be moved easily and joined end to end to form a continuous workbench. There are over 1300 combinations of "Hallowell" workbenches available.

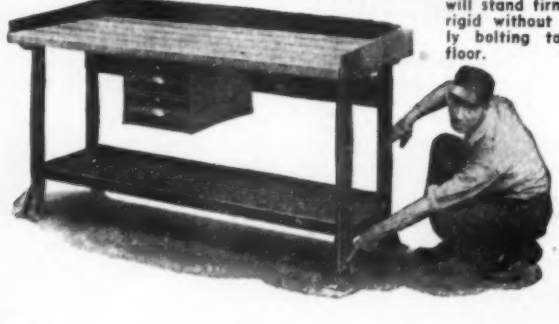


CONVENIENCE

"Hallowell" workbenches of steel can be outfitted with a number of interchangeable shelf, drawer and cabinet units, thus assuring you of having just the right type for your particular needs. "Hallowell" benches are *ready-made*, too, saving you the inconvenience of construction costs, designs, and added expense.
And deliveries, everything considered, are prompt.

STURDY CONSTRUCTION

Built for exceptional durability under everyday wear and abuse, "Hallowell" workbenches give you long years of service. They are built sturdily . . . will stand firm and rigid without costly bolting to the floor.



Write for the free "Hallowell" Catalog of Shop Equipment. "Unbrako" and "Hallowell" products are sold entirely through distributors.

OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

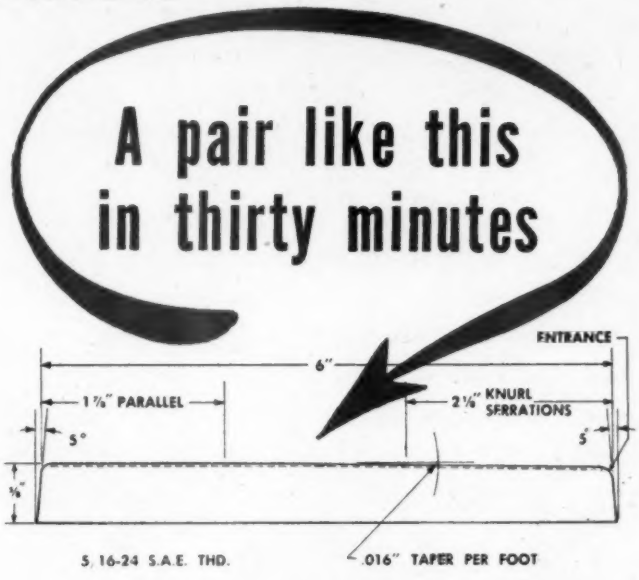
JENKINTOWN, PENNA. BOX 4

Boston, Chicago, Detroit, Indianapolis, St. Louis, San Francisco

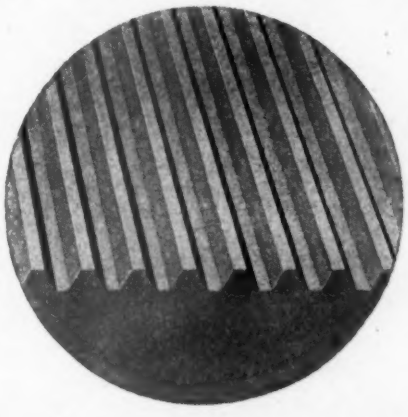
GRIND thread rolling dies?

...*the answer is* **YES!**

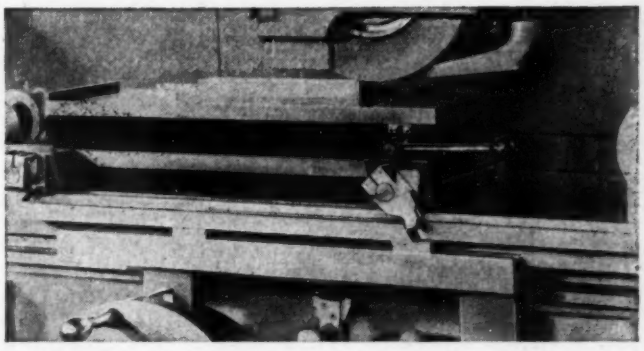
Now—through a new application of THOMPSON TRUFORMING—you can produce accurate duplicate roll thread dies and eliminate subsequent corrective operations formerly required. An example is the roll thread die shown here.



This is the Stationary Die (a perfect mate to the Moving Die not shown). Both were ground on a THOMPSON TRUFORM grinder from heat-treated alloy steel in less than thirty minutes. Note the radii, the precise taper and flat section. This is produced with a single cut—to full depth of thread form without resetting.



Enlarged tooth section shows form of threads and helix angle. By TRUFORMING dies are perfectly matched . . . there is no distortion.

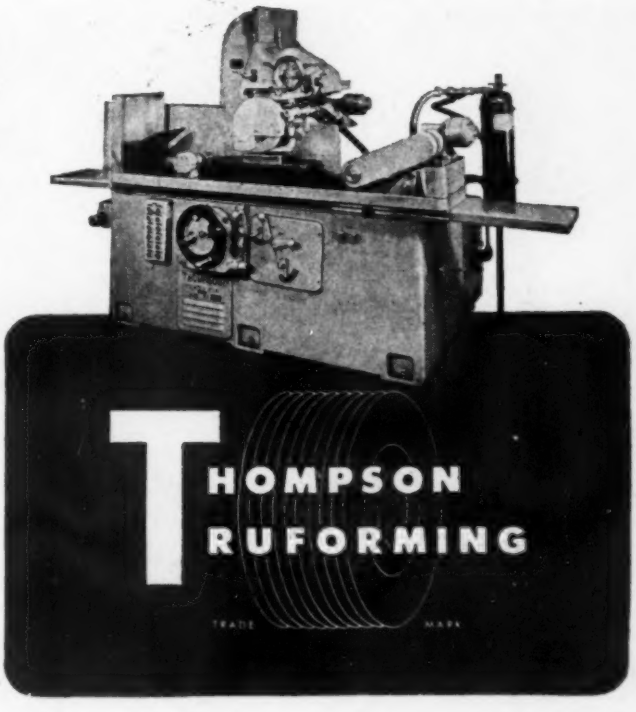


Deformities are eliminated by TRUFORMING because work is finished right in hardened steel. Note the special forming fixture in the photograph, which makes possible completely automatic and highly accurate grinding of the longitudinal contour. These Thompson die grinding features are new with patents applied for.

Longer die life and greater die accuracy, plus ability to regrind dies without drawing, are three great advantages you get with this THOMPSON TRUFORMING application.

Write at once for complete details . . . Address Dept. 10.

The Thompson Grinder Company • Springfield, O.



15,000 revolutions demands

PRECISION is the keynote of production at the Sharples Corporation, Philadelphia. The separators they manufacture use centrifugal force to divide various liquids into light and heavy components. To attain this centrifugal power, moving parts of the separators must rotate at exceptionally high speeds. The large bowl shells of most separators, for example, whirl at the rate of 15,000 r.p.m.—250 times a second!

Utmost accuracy is necessary in producing parts for these separators to insure optimum clearance when the machines are in motion, to avoid vibration, and to provide for long, trouble-free operating life.

That is why Warner & Swasey Turret Lathes are used. Their rigidity holds extreme accuracy and produces fine finishes even on large chucking operations like those shown here. For example, a big, heavy-duty Warner & Swasey 4-A turns, bores and faces a large stainless steel ring forging to tolerances of a half a thousandth of an inch.

The ability of Warner & Swasey Turret Lathes to produce parts to such extreme degrees of accuracy has helped many firms earn a reputation for precision products. Our representative can show you how this accuracy, along with the speed, power, and ease of operation of Warner & Swaseys, can work for your benefit in improving and speeding production, and lowering costs.

Rigidity Needed for Heavy Chucking Jobs. *The massive work piece shown here is a bowl shell for an oil separator. It takes the unusual rigidity of a Warner & Swasey to turn this 250-lb. stainless steel forging to the high accuracy called for.*

Precision Finished to .0005". *An important part of an oil separator is the stainless steel ring shown being turned in this picture. A Warner & Swasey 4-A Turret Lathe, equipped with cross sliding hex turret, turns, bores and internal faces the piece to the close tolerance of plus or minus .0005".*

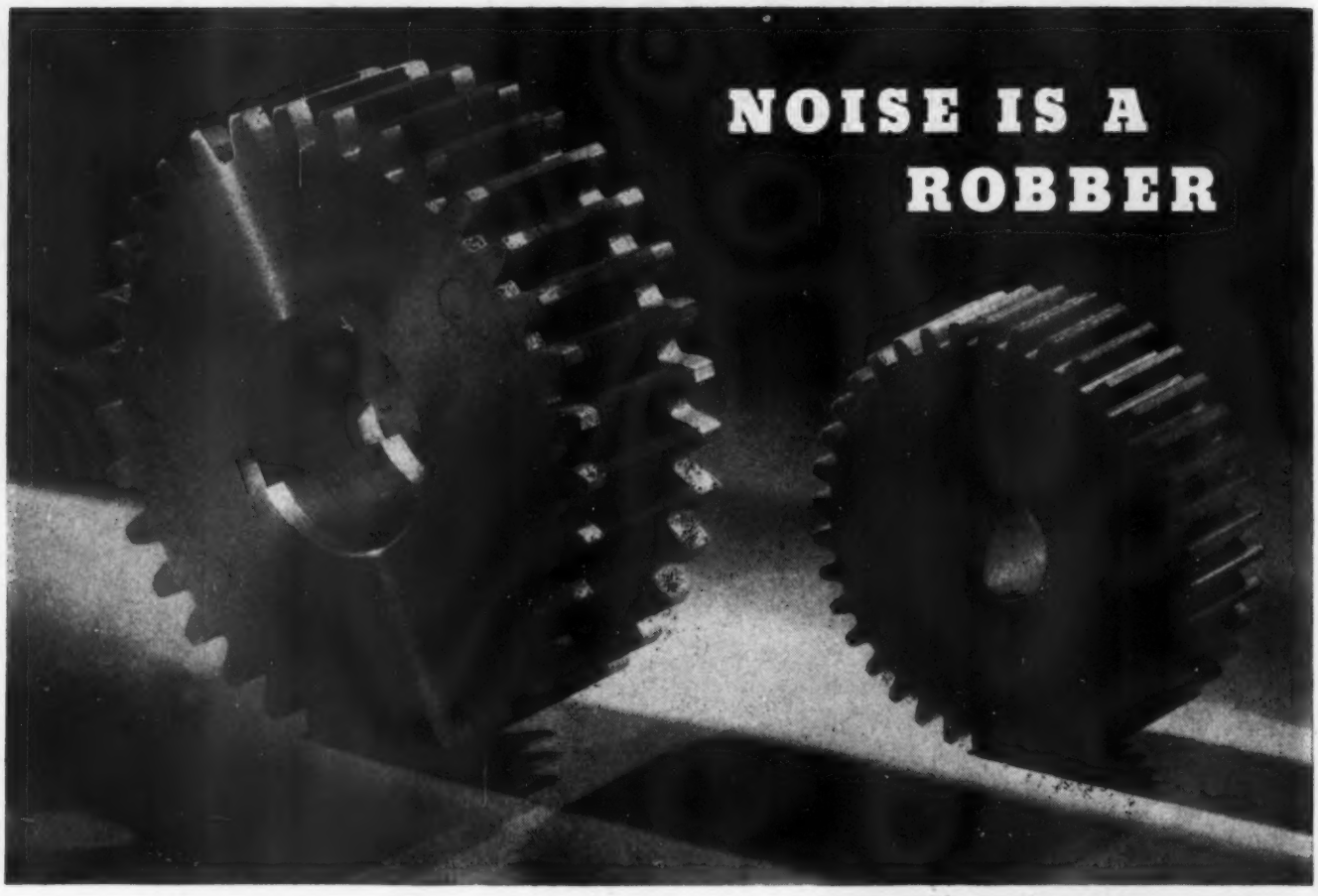
per minute
Peak Precision

Final Inspection Calls for Close Tolerances. *The completed bowl shell (22¾" outside diameter) of the oil separator must be concentric within .002 for perfect clearance when rotating at high speed.*

You can machine it better, faster, for less . . . with a Warner & Swasey

WARNER & SWASEY
Machine Tools
Cleveland

TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES



HOW G-E NONMETALLIC GEARS ELIMINATE EFFICIENCY-STEALING GEAR NOISES

In each of the three machines shown here, it was found imperative that efficiency-stealing gear noises be eliminated if top production were to be achieved. And the G-E nonmetallic gears which were installed are doing just that. They give the required silent operation in all three difficult applications—coal conveyor, vertical boring mill, heavy-duty coal crusher.

G-E nonmetallic gears are also utilized in hundreds of other types of equipment. Daily, their silencing features result in dividends—increasing production by relieving workers of noise fatigue . . . improving the attitudes of employees by eliminating the mental strain and confusion which results from high sound levels.

If excessive gear noise is robbing your plant of maximum production, investigate G-E nonmetallic gears as a remedy.

Contact your gear cutter for further information. For the bulletin, "Silent Gears," write to Section Y-6, General Electric Company, Plastics Divisions, Chemical Department, One Plastics Avenue, Pittsfield, Mass.

TWO TYPES OF G-E SILENT GEARS ARE AVAILABLE

G-E FABROIL
for heavy-duty applications consist of compressed cotton fibers held together by steel shrouds and threaded studs.

G-E TEXTOLITE
for lighter jobs consist of numerous layers of woven fabric held in compression by a phenolic resin.

BOTH ARE SILENT—STRONG RESILIENT

GENERAL ELECTRIC

CD46-P6

Powerhouse Coal Conveyor

Vertical Boring Mill

Heavy-Duty Coal Crusher

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

A. O. Smith's new plant at Kankakee will have the largest radiant heating plant on record. Water, heated to 140 deg. by 120 separate heaters will circulate through 40 miles of pipe laid in the floor slab.

get ready with CONE for tomorrow

The making of acetylene from natural gas is being studied and reports may be expected from the Department of Commerce.

get ready with CONE for tomorrow

Muncie Gear Works proposes to market a "reverse cycle" heating plant this year.

get ready with CONE for tomorrow

Truck bodies of magnesium are being made by Barry and Bailey Co. of Philadelphia.

get ready with CONE for tomorrow

Blue Mountain Clay Co. of Memphis makes a new oil, grease and water absorbent for oily and wet floors that is said to absorb 120% to 140% of its weight.

get ready with CONE for tomorrow

The Public Health Service announces that satisfactory substitutes for mercury have been found that end the hazard of mercury poisoning (the origin of the term "mad hatter") in the hat making industry.

get ready with CONE for tomorrow

In a new thickness gage, designed by Glenn L. Martin Co., a dial registers the deflection of a sheet of metal when a predetermined vacuum is created on one side of it.

get ready with CONE for tomorrow

The idea of the variable pitch propeller has been applied to industrial fans by Evans Products Co. Operated by a built-in thermostat, it maintains constant engine operating temperature.

get ready with CONE for tomorrow

An electrically conductive, nonsparking linoleum has been introduced by Congoleum-Nairn.

General Electric has patented a new type of household refrigerator which maintains temperature at two levels simultaneously.

get ready with CONE for tomorrow

The Bureau of Mines has recently released information on its process for the electrolytic method of producing manganese.

get ready with CONE for tomorrow

Pullman-Standard has increased its output of car wheels ten times by using a machine which revolves the tool instead of the wheel.

get ready with CONE for tomorrow

National Tube Co. claims that its new plant at Lorain, Ohio, is the world's first straight-line seamless pipe mill. It produces 2,000 feet of seamless steel pipe per minute.

The Office of Technical Services of the U. S. Dept. of Commerce reports on a silver-magnesium solder that can withstand the heat of gas turbines.

get ready with CONE for tomorrow

"Multi-tule", a profile blade type form tool holder, is to be made available to users of a well-known make of multi-spindle automatic lathes. The holder is particularly adaptable to short runs and cuts down time in tooling change-overs. It reduces the number of holders ordinarily required for a number of jobs.

get ready with CONE for tomorrow

Dr. Baetjer, of Johns Hopkins University, prophesies that by 1950 one in every three women over fourteen will be employed in industry.

get ready with CONE for tomorrow

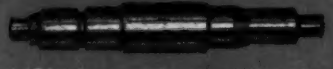
The *USS Salem* and *USS Newport News*, now being built, will be the first ships in what is promised to be a completely air-conditioned Navy.

FOLLOW THESE PAGES FOR NEWS OF PROGRESSIVE PRODUCTION

Emphatically Conomatic!

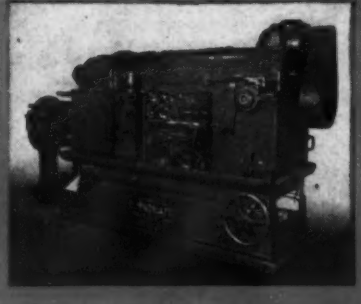
25⅝" long, 16 operations in 63 seconds from 1⅜" dia. hot rolled.

10⅞" long, 16 operations in 65 seconds from 1 41/64" dia. SAE 4620.



10⅝" long, 12 operations in 54 seconds from 1⅝" dia. SAE 3115.

Any good multiple spindle automatic should handle the ordinary run of shaft work. But Conomatics are also adaptable to the unusually *tough* jobs. The illustrations show this plainly.

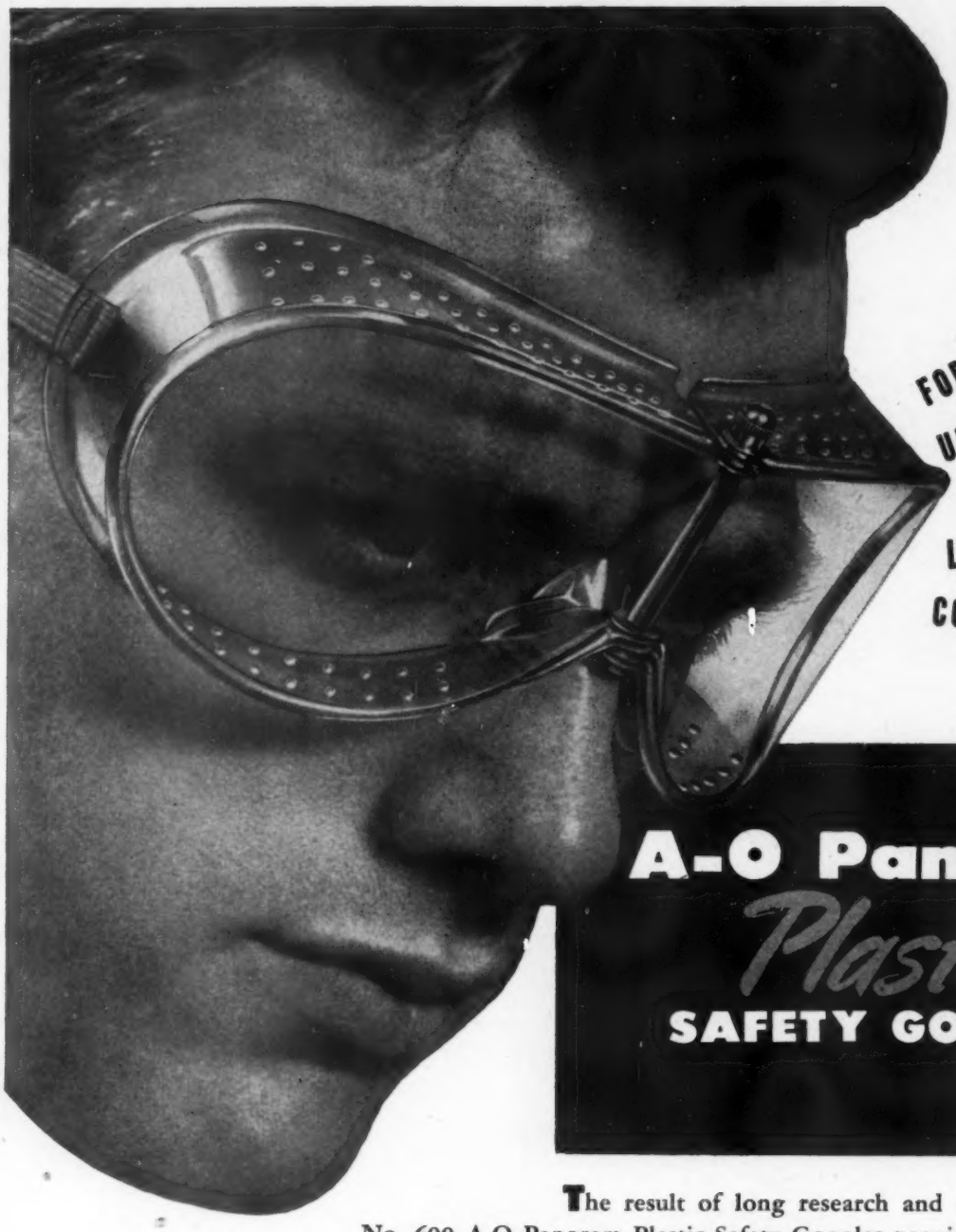


Ask your CONE *representative to show you our new color motion picture*

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

35



FOR SAFE, UNOBSTRUCTED VISION WITH LIGHTWEIGHT COMFORT

A-O Panoram *Plastic* SAFETY GOGGLES

The result of long research and experimentation, the new No. 600 A-O Panoram Plastic Safety Goggles provide safety, clear wide-angle vision, lightweight comfort and attractive appearance. They have *easily replaceable* plastic lenses; frames that conform closely to forehead and facial contours; eyecups that provide maximum protection, yet give sufficient ventilation to reduce fogging; bridge which fits any size nose comfortably—without pressure or facial resistance. Goggles may be worn directly over eyes or over personal glasses. Frames and lenses are available in either clear or green acetate. Especially recommended for jobs such as chipping, grinding, babbitting, riveting, hand tool and machine operations, rail and rivet cutting and spike driving.

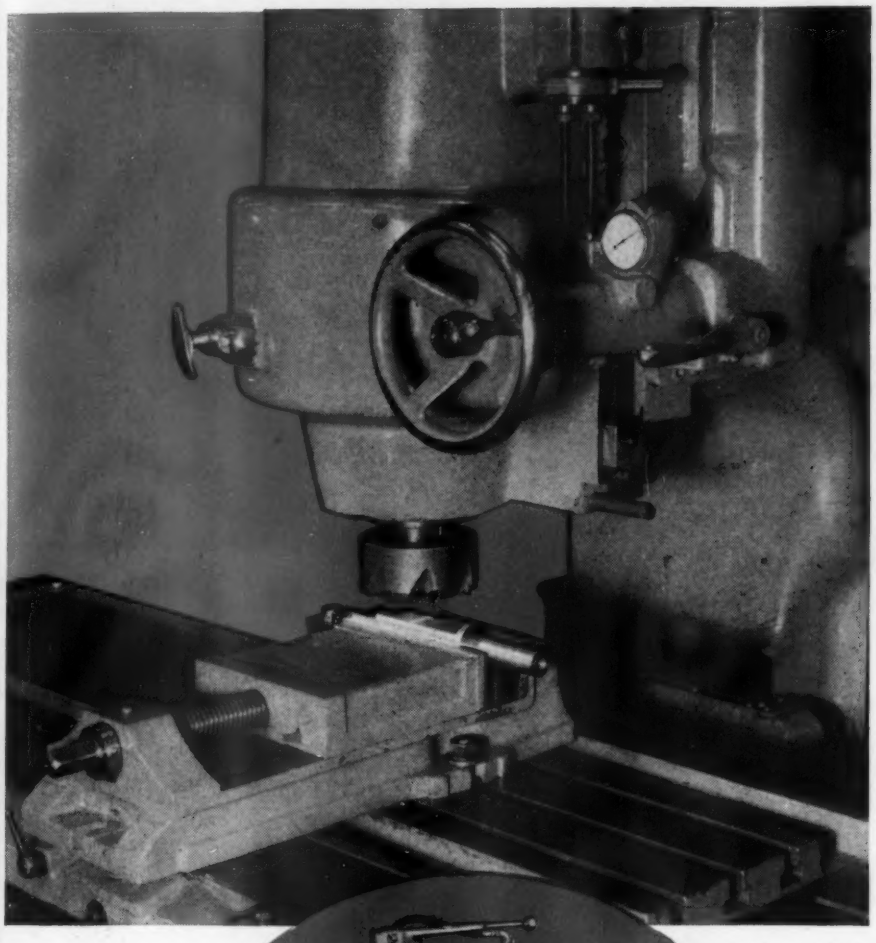
Send to your nearest A-O Safety Representative for bulletin which describes the many unusual features of this new A-O development.

American Optical Company
Safety Division

SOUTHBRIDGE, MASSACHUSETTS
BRANCHES IN PRINCIPAL CITIES

STAINLESS STEEL MILLING

Made easy on a Kearney & Trecker CSM



THE JOB

Stainless steel is difficult to mill under almost any circumstances—but this super-powered CSM, equipped with the proper cutter literally "walked through" this job.

OPERATION:	Rough Mill Stud
MATERIAL:	Stainless Steel
CUTTER:	6" Dia.; 8 Tooth
TABLE FEED:	21 IPM
SURFACE SPEED:	346 SFM
DEPTH OF CUT:	.441" (Max.)
FEED PER TOOTH:	.020"
MILLING TIME:	26 Seconds

STAINLESS STEEL STUD

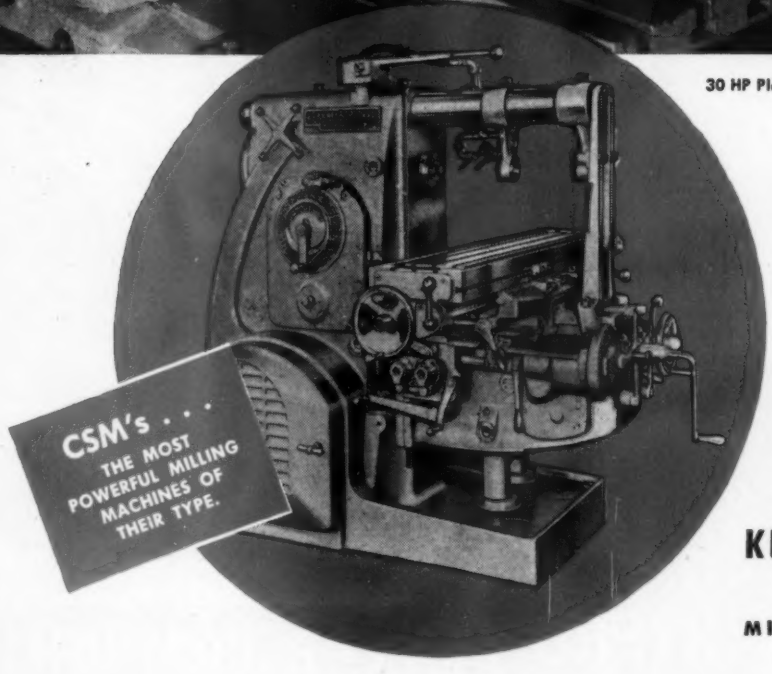
Note the excellent finish obtained despite the high rate of metal removal. The milling time of 26 seconds includes both surfaces. Micrometer stop dial indicator on machine facilitated this step milling operation.

• • •

CSM Milling Machines were designed to obtain the greatest benefits from modern cutting tools, and are now part of our line of standard models. The design has been developed after complete analysis of industry's problems of milling with carbide cutters.

Because they are knee type machines, they are readily adaptable to a great variety of work. They are precision built in accordance with long established Kearney & Trecker standards, and will cut metals faster and to finer tolerances and superior finishes than ever before, with high speed steel cutters as well as carbide cutters.

CSM machines are available in 20, 30 or 50 H.P. models in both plain and vertical knee types.



30 HP Plain CSM

Write for complete data on CSM machines—CATALOG CSM-20. Please indicate your business connection.

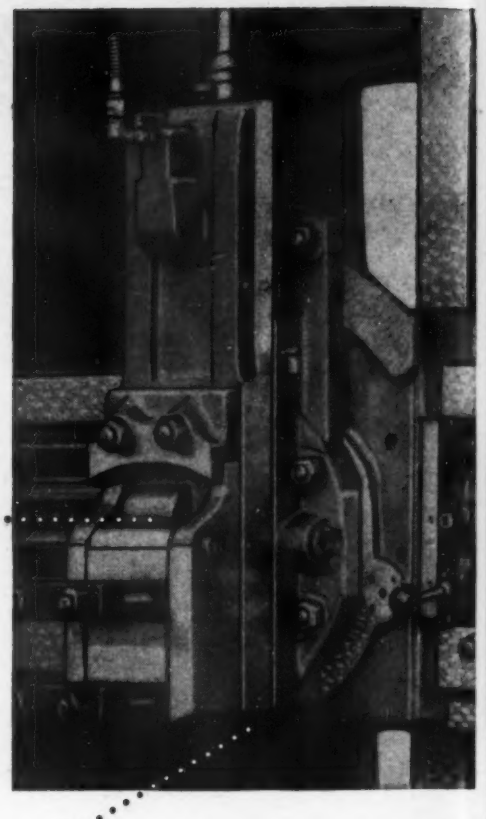
KEARNEY & TRECKER
CORPORATION
MILWAUKEE 14, WISCONSIN

BE READY FOR TOMORROW . . . WITH CSM's

4715

Both *in the Hypro rail head*

. . . these exclusive Hypro dependable features

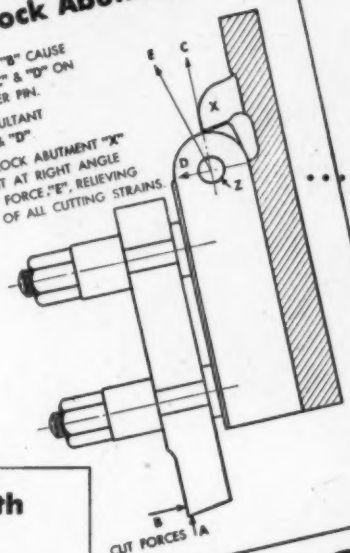


Exclusive Cincinnati Hypro Tool Block Abutment

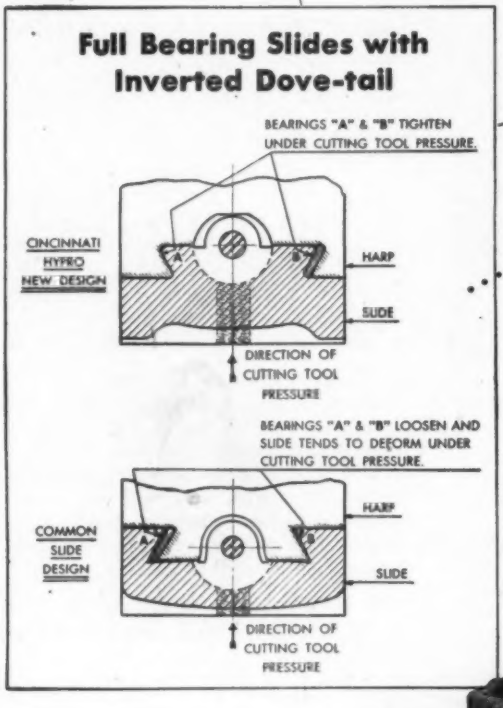
(1.) CUT FORCES "A" & "B" CAUSE ACTING FORCES "C" & "D" ON CLAPPER BOX TAPER PIN.

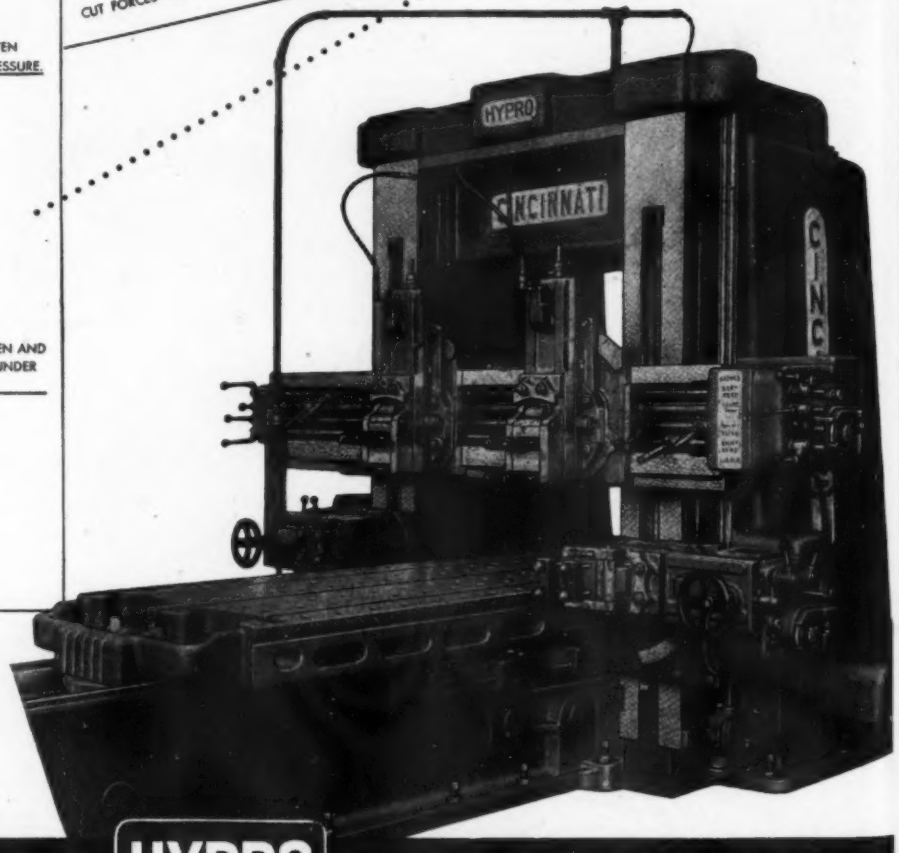
(2.) FORCE "E" IS RESULTANT OF FORCES "C" & "D"

(3.) HYPRO TOOL BLOCK ABUTMENT "X" IS PRECISION FIT AT RIGHT ANGLE TO RESULTANT FORCE "E", RELIEVING TAPER PIN "Z" OF ALL CUTTING STRAINS.



Full Bearing Slides with Inverted Dove-tail

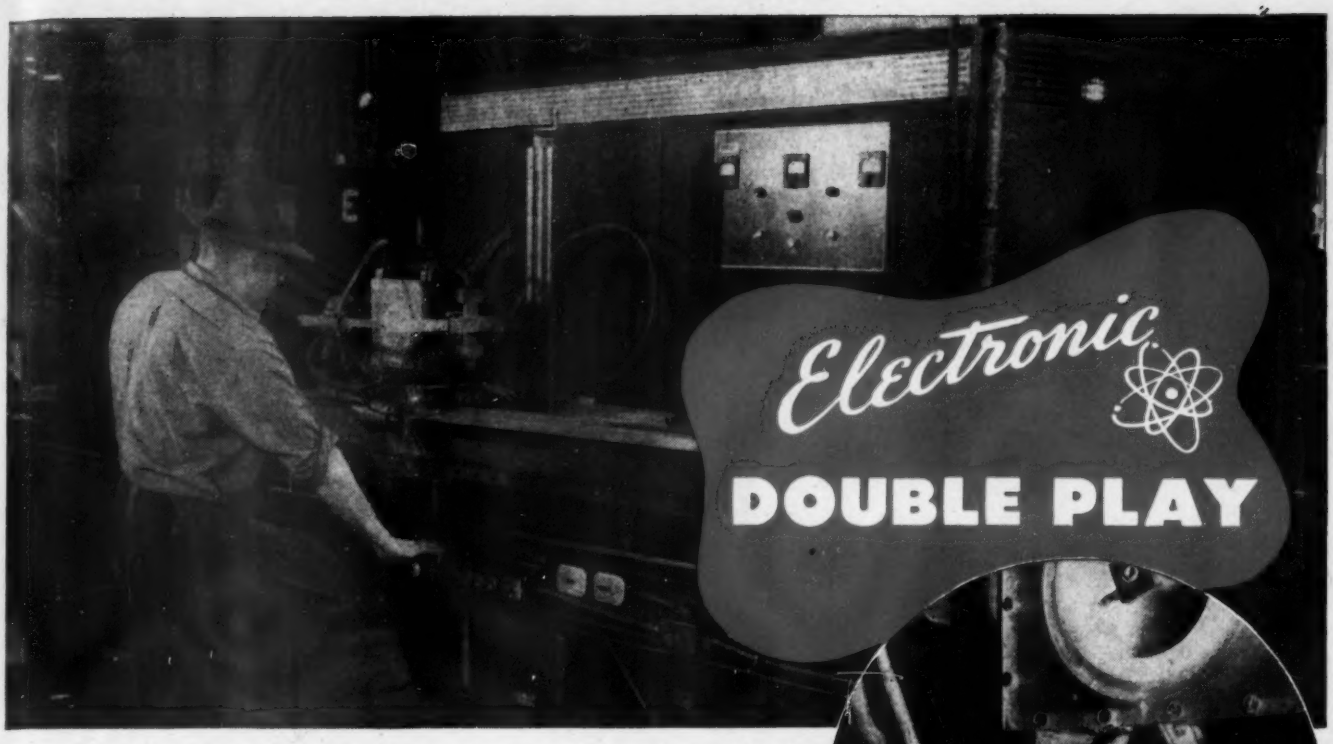

BEARINGS "A" & "B" TIGHTEN UNDER CUTTING TOOL PRESSURE.
CINCINNATI HYPRO NEW DESIGN
HARP
SLIDE
DIRECTION OF CUTTING TOOL PRESSURE
BEARINGS "A" & "B" LOOSEN AND SLIDE TENDS TO DEFORM UNDER CUTTING TOOL PRESSURE.
COMMON SLIDE DESIGN
HARP
SLIDE
DIRECTION OF CUTTING TOOL PRESSURE



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

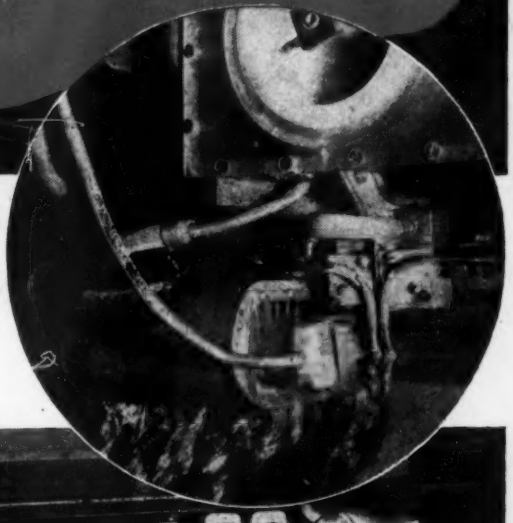


G-E ELECTRONIC HEATER and THY-MO-TROL DRIVE SOLVE DIFFICULT DIE-HARDENING PROBLEM

How could the wearing surfaces of brake dies measuring up to 20 feet in length be efficiently hardened? Because of the distortion difficulties due to the length of the dies, furnace hardening and salt-bath hardening were out of the question.—This was the problem referred to G-E engineers by the Dreis & Krump Manufacturing Company in Chicago.

After carefully analyzing the production requirements of this company, G-E heating specialists scored an electronic double play. The dies to be hardened are passed under the work coil of a G-E electronic heater by a G-E Thy-mo-trol-controlled carriage. Since the Thy-mo-trol drive equipment is connected into the plate circuit of the electronic heater, the speed of the carriage varies directly with the power output of the electronic heater. Thus, with this controlled carriage-speed and power-output ratio, the brake dies are hardened uniformly, with close depth control, and with minimum distortion. Also, Dreis & Krump are now producing a better product at a cost considerably lower than that of any other previous method of die hardening.

Perhaps your heat-treating operations could be similarly improved in speed, quality, and economy with G-E equipment and expert heat engineering. We shall be glad to furnish you with detailed information on G-E electronic heaters and to make specific recommendations for their application to your individual requirements. Just fill out and mail the coupon.



Brake-die wearing surface (above), passing under G-E electronic heater's work coil and into quench shoe for hardening.

Detail of electronic Thy-mo-trol equipment (below), for regulating carriage speed with heater's power output.

GENERAL ELECTRIC

Apparatus Dept., Sec. E675-145
General Electric Company, Schenectady 5, N. Y.

My heat-treating problem is.....

.....

.....Please have a G-E heating specialist get in touch with me.
.....Please send me the following free bulletins:
GEA-4284A "G-E 5-Kw Electronic Heater"
GEA-4637 "G-E 20-Kw Electronic Heater"
GEA-4348 "G-E 50-Kw Electronic Heater"

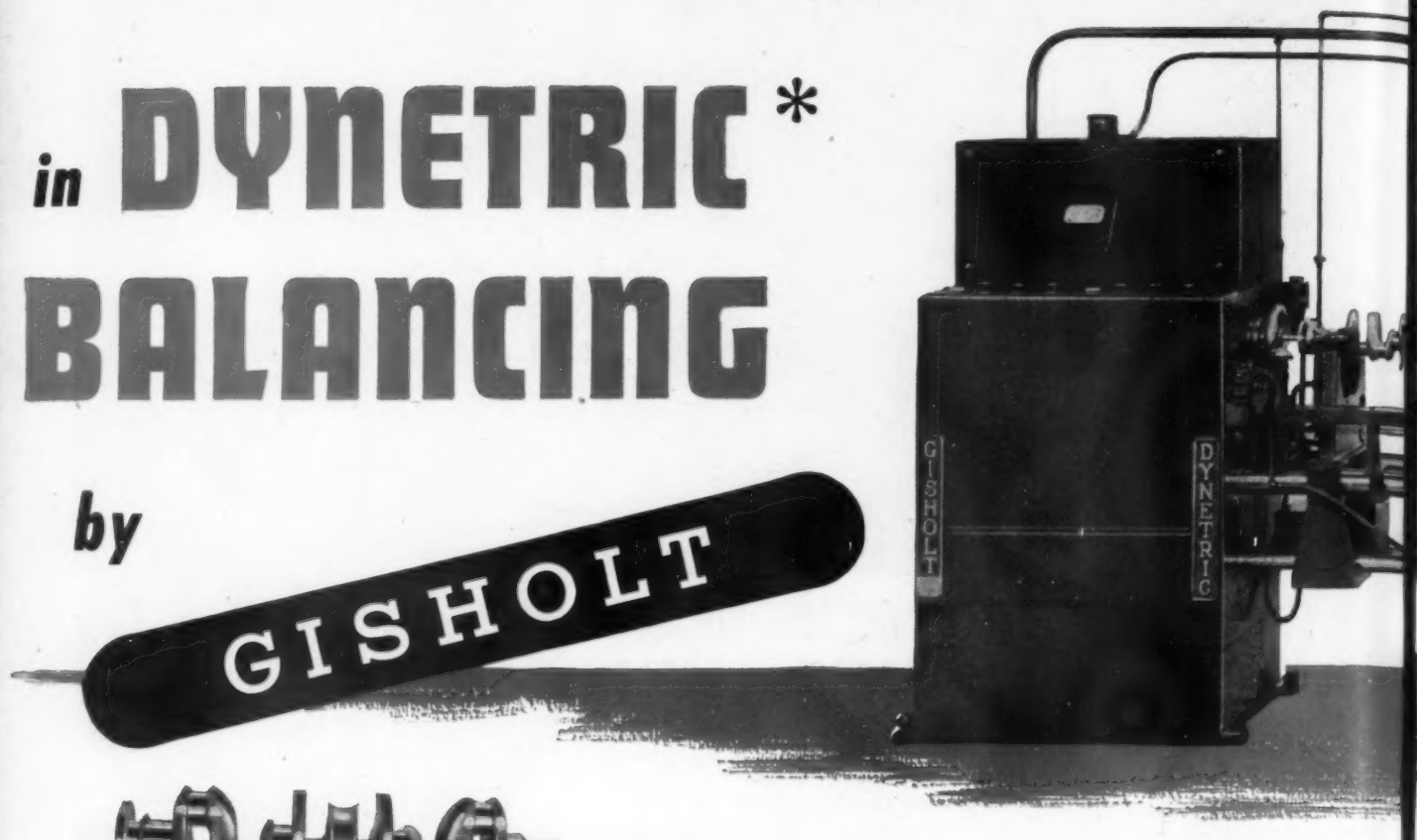
Name.....
Company.....
Address.....
City.....State.....

8744

another history-making achievement

in DYNETRIC* BALANCING

by GISHOLT



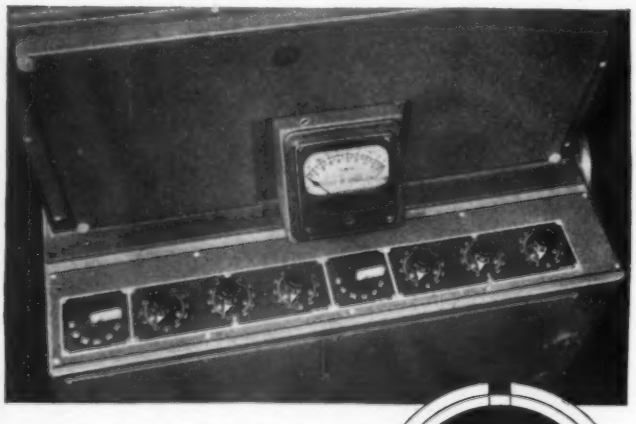
Properly defined, "balancing is a process in which the distribution of mass in a rotor is altered to eliminate vibration at the bearings supporting the rotor."

Gisholt has now developed complete semi-automat equipment to do this—*measuring and correcting unbala* in automotive type crankshafts—with a speed and accura heretofore unknown.

This new Gisholt equipment, as shown above, consists a Type C Dynetric Balancer and a correction drilling m chine, electrically connected. The Dynetric Balancer ind cates directly the amount of metal to be removed fro specific points in the crankshaft to produce accurate sta and dynamic balance. This is done by setting six dials the balancing machine until the indicating meter rea zero. The crankshaft is then transferred by a dolly to t correction machine and positioned in a drilling fixtu

Correction Information Transferred Electrically

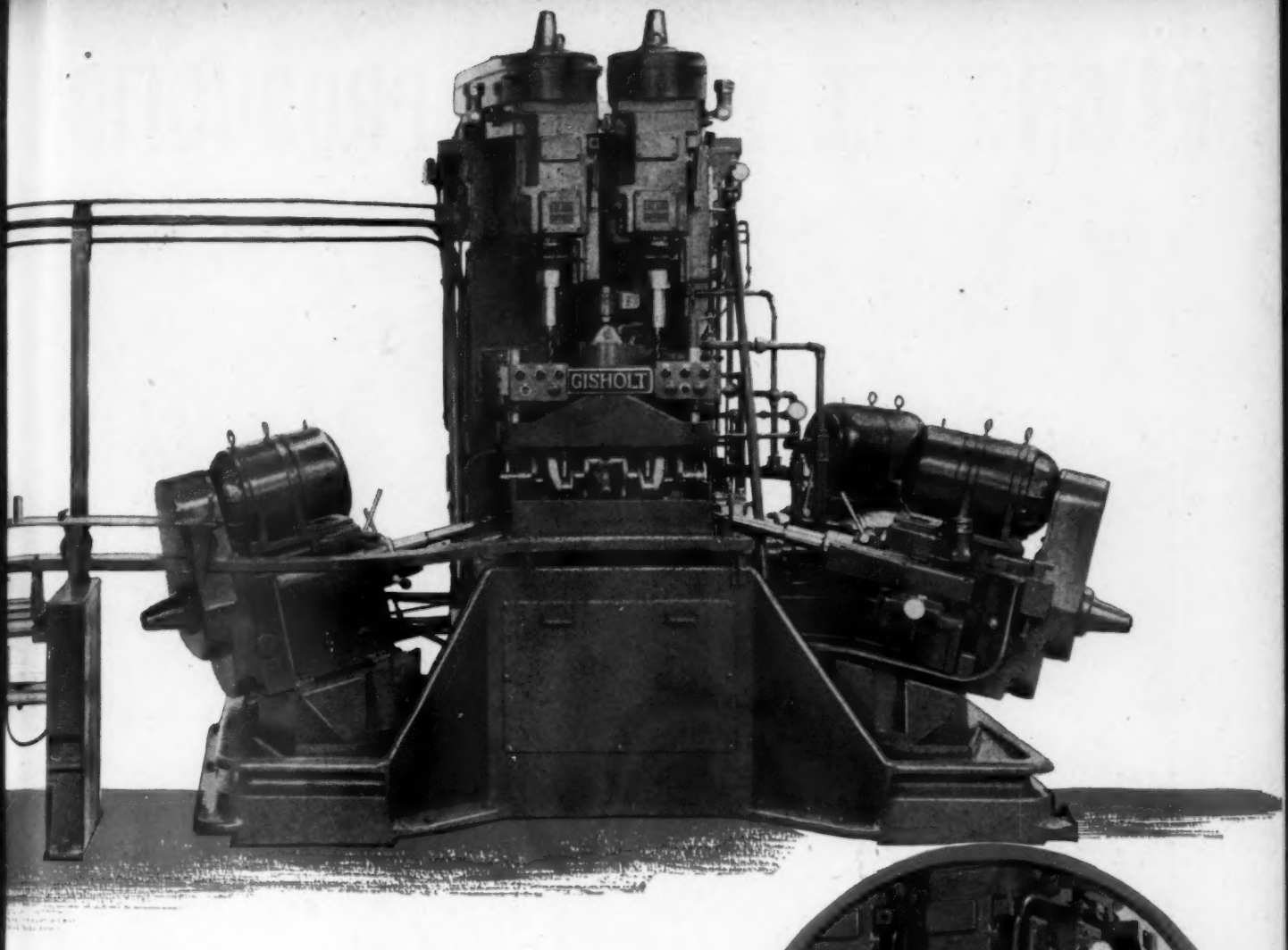
Balancing machine indications are transmitted electrica to the six-spindle drilling machine by means of self-sy chronous transmitters and receivers. The depth of each ho to be drilled is automatically set from the correspondi measurement on the balancing machine. The automatic dri ing cycle, started by push buttons, includes all operatio such as hydraulic clamping, starting drills and flow of co ant, initiating depth measurement of each drill separat as it contacts metal, tripping into back traverse when t measured depth is reached, and returning crankshaft position for removal.



Showing the control dials and meter of the Gisholt Dynetric which measures unbalanced forces at each of six specific points on automotive crankshafts.

GISHOLT

TURRET LATHES • AUTOMATIC LATHES •



Green Light Signals Operator

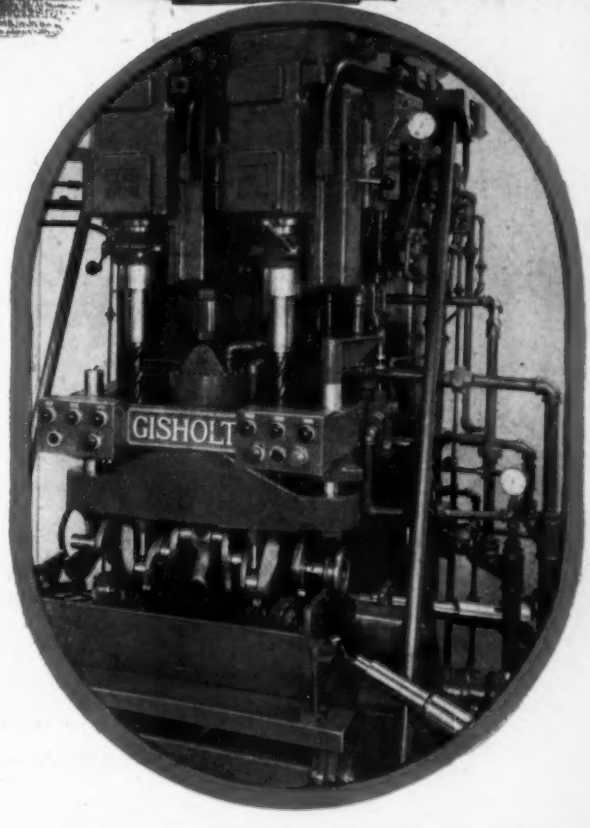
Within three seconds after drilling has started, a green light on the balancing machine advises the operator that the drilling information has been completely transferred so that he can proceed with the measuring of unbalance on the next crankshaft. Thus, operators of both machines work steadily with no lost time.

Time Reduced—Accuracy Increased

The average cycle for measuring and correcting unbalance is 66 seconds, determined by the time required to drill the deepest hole. Accuracy averages 0.2 ounce inches—substantially better than previous standards. And the chances for human error are reduced to a minimum.

This new Gisholt equipment puts accurate balancing of crankshafts on a swift production basis, at lower cost than ever before. It is another example of Gisholt's unquestioned leadership in the field of balancing. Full information is available upon request.

* *Developed jointly with the Westinghouse Electric Corporation*



Close-up of correction drilling machine with crankshaft hydraulically clamped in position as drills advance to six points for metal removal. When any drill becomes dull, a red light automatically warns operator and remains lit until drill point is changed.

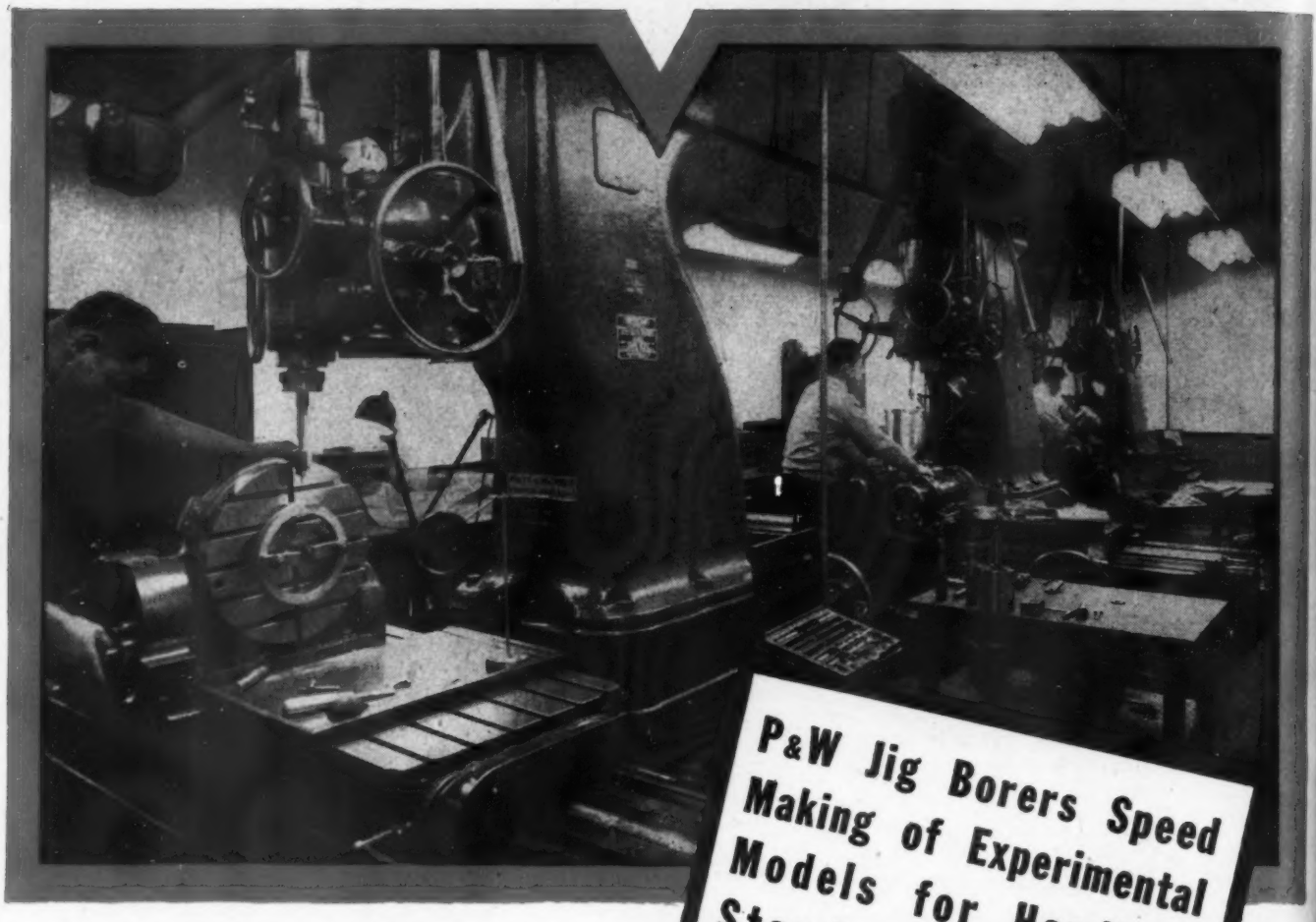
GISHOLT MACHINE COMPANY

1201 East Washington Avenue • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . . with Gisholt

SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

PAVING THE WAY FOR PRODUCTION



P&W Jig Borers Speed Making of Experimental Models for Hamilton Standard Propellers

Accurate experimental models can cut hours, days, even months from the period of research and testing which must intervene between design and full-scale production.

At Hamilton Standard, three Pratt & Whitney No. 3B Jig Borers perform economically, many vital phases of this important step . . . without the need for special tooling.

P&W Jig Borers provide the quick, accurate method of locating, boring and checking all desired holes to "tenths" and for milling some bosses. Thus, P&W Jig Borers are "jig eliminators" as well — for they save the time and expense of making special jigs and fixtures.

P&W Jig Borers pay for themselves over and over by paving the way for production — in making experimental models . . . in boring jigs and fixtures . . . and in small-lot precision boring jobs.

Write on your company letterhead or phone your nearest P&W branch office for full information and the assistance of our engineers in applying P&W Jig Borers to your production problems.

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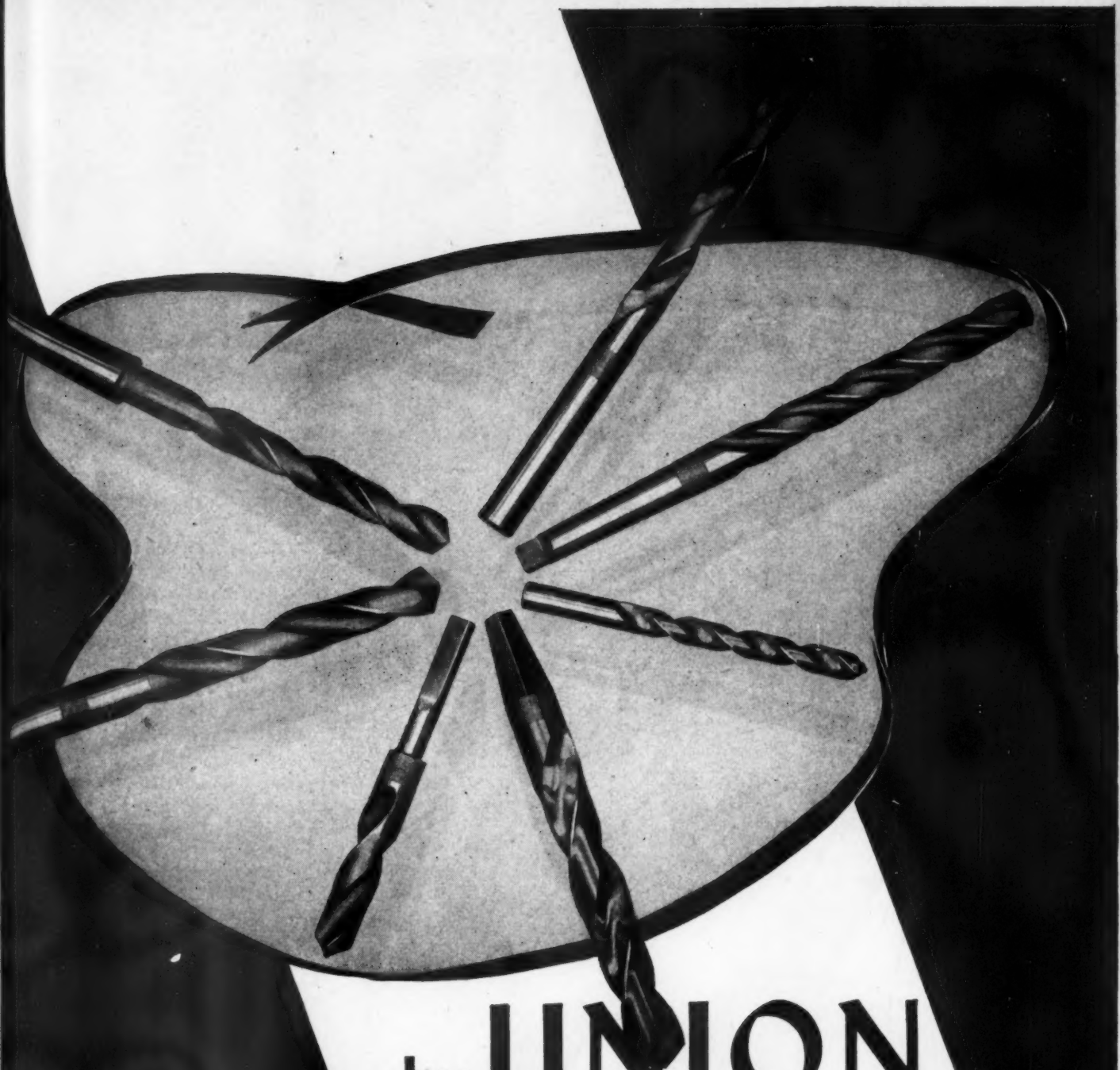

..by UNION

Progress in drill design and manufacture is most apparent in results obtained, not in the laboratory, but on the job. That is where Union Twist Drills have proved their production ability. For the progress you want in your production, stick with the tools that are produced for progress. Choose Union—The Tools You Buy Again.

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DRILL COMPANY
ATHOL, MASS.

UNION ★ BUTTERFIELD ★ CARD Divisions of the Union Twist Drill Company

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SPECIFIED WITH CONFIDENCE

Whatever the job . . . the material . . . the machine . . . the type of thread . . . the accuracy desired, you can specify Card Taps with confidence. Card Taps will deliver the uniformly high output and the exceptionally accurate results that mean profitable production on every tapping job.

The CARD Quality

UNION • BUTTERFIELD • S. W. CARD
Divisions of the Union Twist Drill Co.

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RIGHT ON THE JOB!

There's a right reamer for every job . . . a Butterfield! Choose from the complete Butterfield line and be sure of getting a reamer that's right for the job . . . and one that's right on the job, too —in stamina, in accuracy, in all-'round economical performance.

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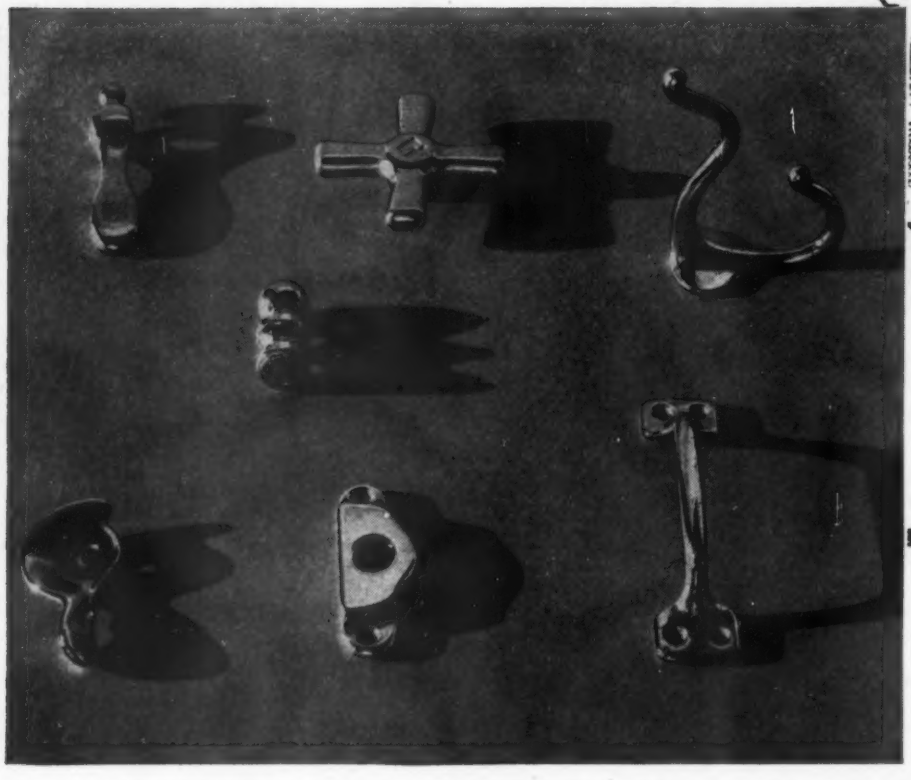
Hand Finishing Costs are High!

ELIMINATE HAND-FINISHING BOTTLENECK!

WITH ROTO-FINISH MECHANICAL FINISHING!



Mechanical Roto-Finish Costs are Low!

Speed Finishing Time and Cut Costs with ROTO-FINISH

Increased labor costs are making the hand finishing of parts an even greater bottleneck. Many prominent companies are avoiding this problem by Roto-Finishing mechanically, stampings, forgings, die castings, sand castings and machined parts.

1. **Roto-Finish produces a surface comparable to that of hand or wheel finishing on many parts.**
2. **Cuts cost from 35% to 60%.**
3. **Produces a more uniform finish on quantity lots.**
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Roto-Finish not only slashes cost and relieves manpower—it is far more accurate. Standards can be set up for finishing that provide the exact surface required on every piece.

Take advantage of our offer to process your parts and furnish complete information. **No obligation. THE STURGIS PRODUCTS CO., 612 Jacobs Street, Sturgis, Michigan.**

ROTO FINISH

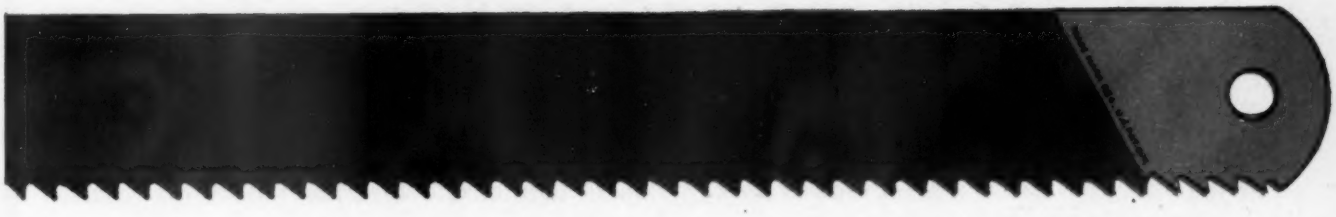
THE UNIFORM MECHANICAL PROCESS—

FOR GRINDING • DE-BURRING • POLISHING • HONING • COLORING

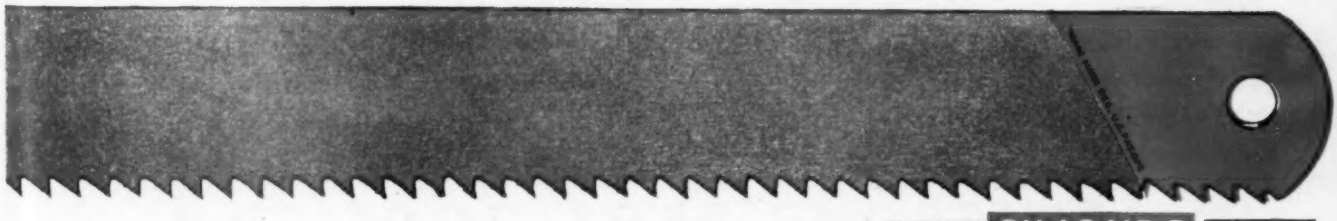
Get SIMONDS

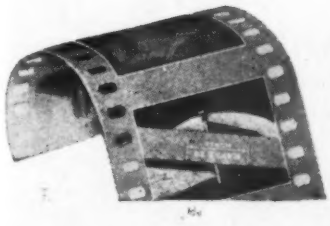
"RED END" HACKSAW BLADES

. . . AND GET A LONGER RUN



FOR YOUR MONEY





SEE SIMONDS SOUND-FILM, in color, showing how to get the best results and longest service out of the finest blades made . . . SIMONDS "Red End" Blades for Hand and Power Hacksawing. You can arrange with your Industrial Supply Distributor for a showing of this interesting movie. Or write to the nearest Simonds office.

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SAW AND STEEL CO.
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Whenever you tool a new operation with the correct ARMSTRONG TOOL HOLDER, you increase your profit. Each has the extra efficiency resulting from over 50 years of continuous development and refinement in designs; the extra strength resulting from modern metallurgy and manufacturing methods.

With ARMSTRONG TOOL HOLDERS you can take advantage of the new high speeds and heavier feeds of the newer cutting materials, without revolutionary changes or costly experimentation. They are the most profitable tools obtainable; the lowest in initial cost, the longest in service and most economical in use, for all incorporate the basic Armstrong Principle of small interchangeable cutter-bits in permanent drop forged shanks. They are the most readily obtainable tools too, for they are stocked by all leading distributors.

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Van Keuren

CARBOLOY WIRE TYPE PLUG GAGES

1 VAN KEUREN CARBOLOY GAGE = 50 TOOL STEEL GAGES

ire type plug gages were originated by The Van en Co. in 1925 and are now recognized as the most omical gages for measuring small holes.

e original wire type plug gages were made of tool . The use of high speed steel doubled gage life. sion chrome plate gave five times the life, and now s of carboloy are available with fifty times the life ol steel. All of these materials are still in use and their particular applications and advantages.

K Carboloy gages are made in sizes from .020" eter to .250" diameter. They are available only in ire type design as this is by far the most economical l plug gage. In cases where it is desired to use Keuren carboloy wire type Go units with existing Go units of the taper insert design, special handles be furnished for this purpose. Van Keuren wire plug gages assure longer lasting precision and r gage cost because the entire 2" length of gage can be used. When the end becomes worn it is ground off and a new section of the original accuracy is moved out for use. The wire type unit is securely held in the handle by a split bushing and a headless set screw.

VK Carboloy wire type plug gages are made to Class B accuracy, plus .00005" minus .00000" on the Go unit and plus or minus .000025" on the No Go unit. Closer or wider tolerances can be supplied if desired.

On your next order specify VK wire type plug gages. VK Carboloy for long runs because of the enormous saving in gage cost. VK Carboloy for fussy jobs because of the infinitesimal gage wear and insurance that the parts will be within the specified limits. VK Tool Steel—High Speed—Precision Chromium for less exacting jobs. You will be assured of the best in accuracy, quality and delivery.

Write for circular C 35 on Carboloy wire type plug gages, Thread measuring wires and Gear wires.

Write for your copy of catalog and handbook No. 33. It contains complete information on Van Keuren precision gages and instruments and valuable engineering formulas and data on measuring problems.

IE Van Keuren CO., 176 WALTHAM STREET, WATERTOWN, MASS.

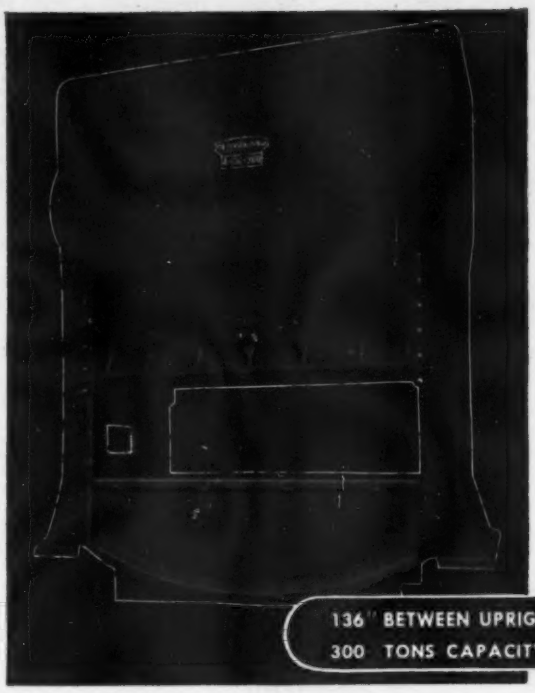
27th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires.

1946

Cleveland Four Point Presses

84" BETWEEN UPRIGHTS
300 TONS CAPACITY



136" BETWEEN UPRIGHTS
300 TONS CAPACITY

CLEVELAND

108" BETWEEN UPRIGHTS
500 TONS CAPACITY

144" BETWEEN UPRIGHTS
750 TONS CAPACITY

The above illustrations are typical of the Cleveland line of Modern Four Point Presses which can be furnished in a wide range of capacities, and with stroke, adjustment, shut height and bed area to suit particular requirements.

Manufacturers interested in this line of Modern Presses should write for a copy of our catalog on Single Point, Two Point and Four Point Presses.

Modern Presses THE CLEVELAND PUNCH & SHEAR WORKS COMPANY *Cleveland, Ohio*

NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • PITTSBURGH

For greater *accuracy, speed* and *economy* in *your* thread cutting

MODERN

STATIONARY TYPE SELF-OPENING

DIE HEADS

Modern Self-Opening Die Heads thread diameters from ⅛" to 7" in standard heads, and up to 14" in special heads . . . accurately, fast, and economically. They are adapted to practically every thread cutting operation within their capacity. Designed for use in hand screw machines, turret lathes, and other machines where the die heads are used in a stationary position.

PROMPT SHIPMENT....USUALLY FROM STOCK

- Wider threading range with greater flexibility. Unusually well suited to general purpose diversified threading work.
- Soundly designed and carefully built to insure maximum productiveness combined with long lasting, accurate service.
- Made with the least number of parts. Hardened and ground throughout. Wear is held to a minimum.
- Simplified design makes chaser change quick and easy. No special tools required.

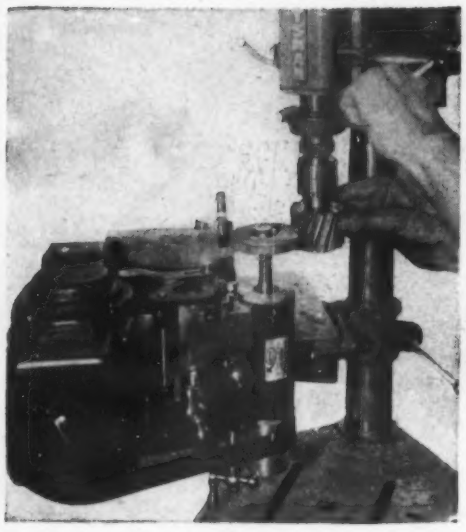
MODERN TOOL WORKS

DIVISION OF

CONSOLIDATED MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

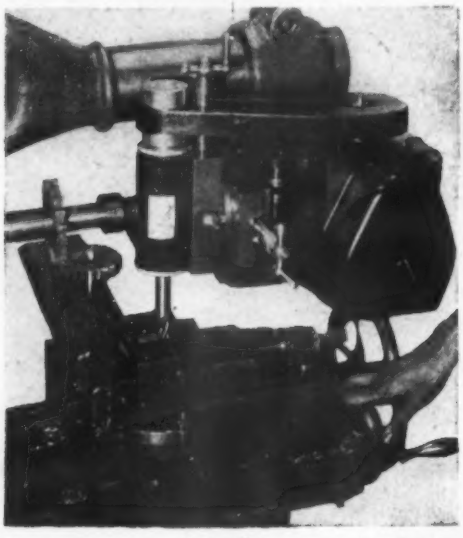
KOETT
UNIVERSAL INC.



DRILL PRESS MOUNTED

Spiral or straight cutters can easily be ground on drill press as well as many other operations, both wood or metal.
You get *precision!* To tenths of a thousandth if needed . . . That's *performance!*

Talk about versatility! The KOETT Universal is truly amazing . . . simply mount it on the compound of an engine lathe or the carriage of a turret lathe and it's ready for perfect, precision milling, grinding, boring and dovetailing due to its dynamic balance. And it's a marvel of compact simplicity . . . dead easy to handle!



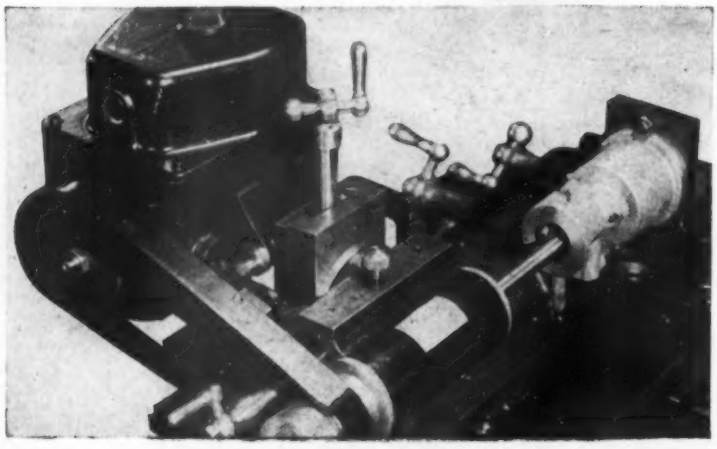
MILLING MACHINE MOUNTED

- **Absolutely perfect for all external and internal grinding!**
- **Ideal for valve-grinding!**
- **The best yet for precise honing of piston walls, lapping and honing brake cylinders!**
- **Quick, accurate keyways, grooves!**

Now you can do vertical milling on your horizontal milling machine by attaching KOETT to the overarm without disturbing the horizontal set-up.

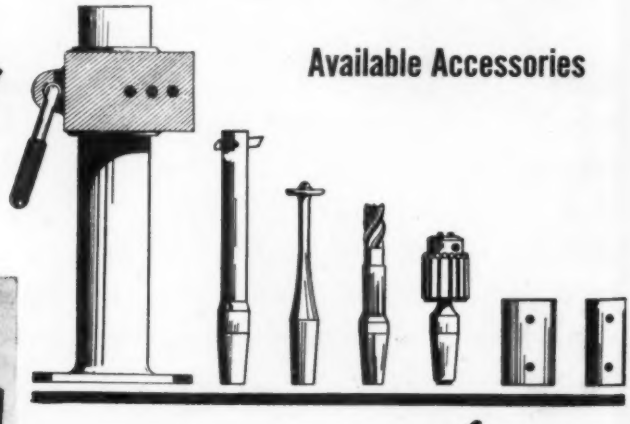
Just name the job . . . KOETT Universal can handle it quickly, accurately. Operates equally as well in a vertical or up-end position. You owe it to yourself to discover the time-saving, money-saving help that KOETT Universal can be in YOUR shop!

LATHE MOUNTED



Off-balanced castings can easily be bored in this position—close tolerances very easily held by mounting machine on tail stock end of your lathe.

Available Accessories



Koett does the job better in one half the time!

is the answer!

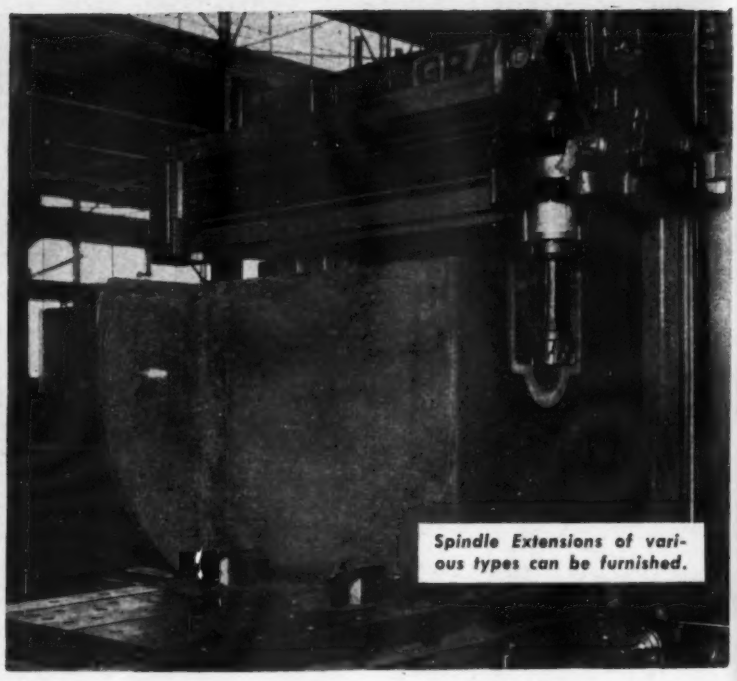
500 TO 40,000 R.P.M. A.C. or D.C.
VERTICAL TRAVEL UP TO 5" IN THOUSANDTHS
HORIZONTAL TRAVEL UP TO 2" IN THOUSANDTHS
OIL SEALED FOR LIFE & DYNAMICALLY BALANCED
30° LEFT OR RIGHT TILT

KOETT
UNIVERSAL INC.

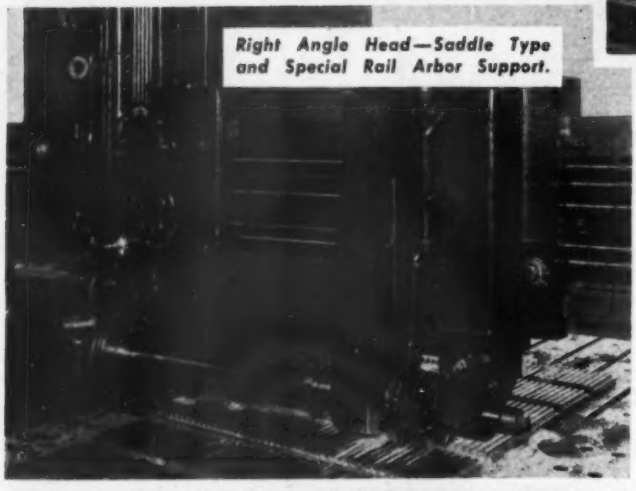
Complete Information
Furnished Promptly on Request.

KOETT Universal, Inc.
ONEONTA, N. Y.

Side head fastened to rail and fed up and down as a unit. Note Arbor support mounted on rail.



Spindle Extensions of various types can be furnished.



Right Angle Head—Saddle Type and Special Rail Arbor Support.

Right Angle Head — Special Bore-Milling Type.

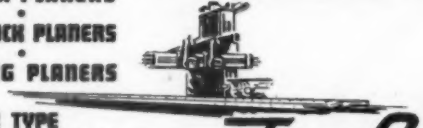
Supplemental Equipment

. . . and Special attachments add greatly to the range of work that can be handled to the best advantage on Gray Unit Head Milling Machines.

Write for fully illustrated descriptive bulletin No. 51.

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
•
MILLING PLANERS

PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES



The G.A. GRAY Co.

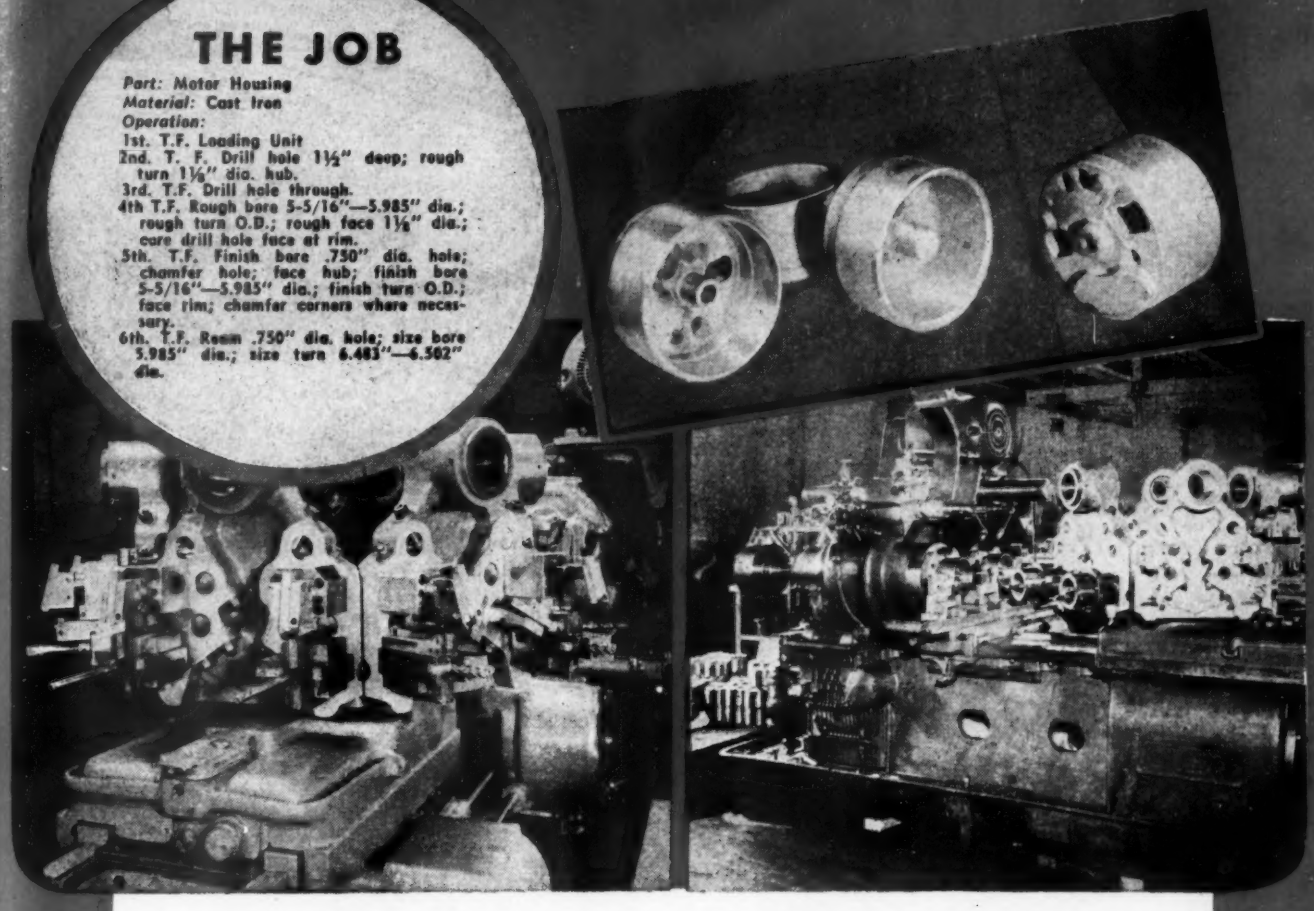
CINCINNATI 7, OHIO, U. S. A.

SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

Tooling on a P&J 5 D 2 AUTOMATIC contributes to Outstanding Production Perfomance

THE JOB

Part: Motor Housing
Material: Cast Iron
Operation:
1st. T.F. Loading Unit
2nd. T. F. Drill hole 1½" deep; rough turn 1⅛" dia. hub.
3rd. T.F. Drill hole through.
4th T.F. Rough bore 5-5/16"—5.985" dia.; rough turn O.D.; rough face 1½" dia.; core drill hole face at rim.
5th. T.F. Finish bore .750" dia. hole; chamfer hole; face hub; finish bore 5-5/16"—5.985" dia.; finish turn O.D.; face rim; chamfer corners where necessary.
6th. T.F. Ream .750" dia. hole; size bore 5.985" dia.; size turn 6.483"—6.502" dia.



Ability to duplicate the cast iron motor housings shown here quickly and accurately on the P&J 5D2 Automatic is the result of planned tooling and the well-known productivity of two-spindle performance. The actual figures for floor-to-floor time and number of pieces per hour are outstanding and will be furnished on request.

All P&J machines have the inherent advantage of tooling flexibility, making possible not only special tooling for each specific job but also the means of changeover in tooling for the wide range of jobs that can be handled on these highly productive machines.

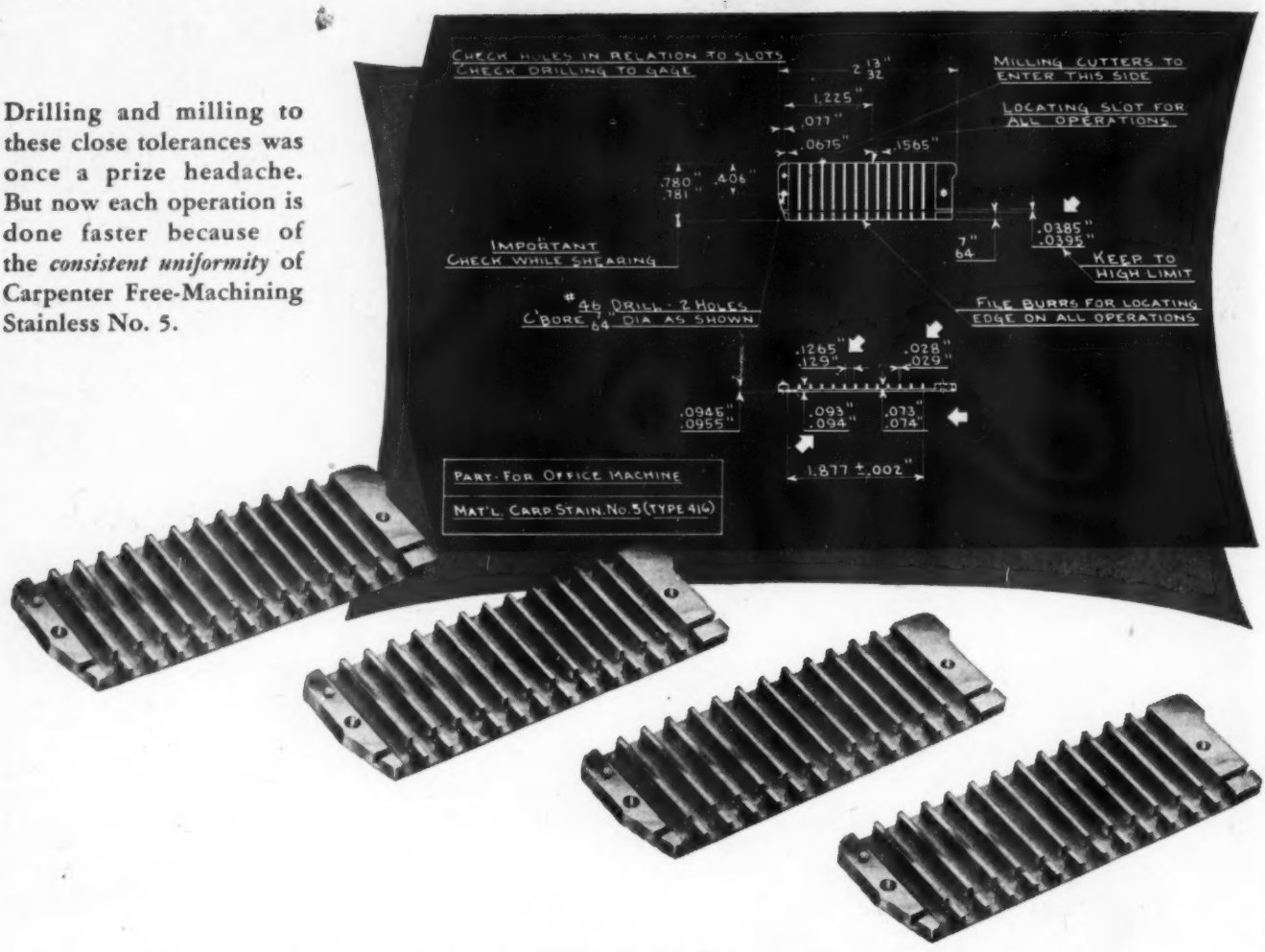
Utmost turret stability is assured by the rigid type overhead pilot which is characteristic of P&J design. This feature together with ample power makes it possible to produce accurately at high speed and low maintenance. Operating convenience results in minimum fatigue and conserves man-power.

Our engineers are ready to help you cut costs in duplicate parts production and welcome an opportunity to show you how it can be done.

THE POTTER & JOHNSTON MACHINE CO.

Pawtucket Rhode Island

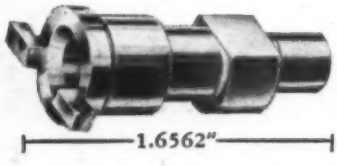
Drilling and milling to these close tolerances was once a prize headache. But now each operation is done faster because of the *consistent uniformity* of Carpenter Free-Machining Stainless No. 5.



You Can Turn It Out *for less*

with Carpenter Free-Machining Stainless

The point on this carburetor needle is made to close tolerances and the needles are produced economically, thanks to the easy machining properties of Carpenter Stainless No. 5. The special cold drawn shape as supplied from the mill also reduced the total amount of machining needed on the job.



On this job the manufacturer got more than the corrosion resistance and strength of Stainless when his orders specified Carpenter Free-Machining Stainless No. 8. Its uniform machinability from lot to lot saved fabricating dollars every day.

• Easier Stainless Fabrication
• Lower Unit Costs

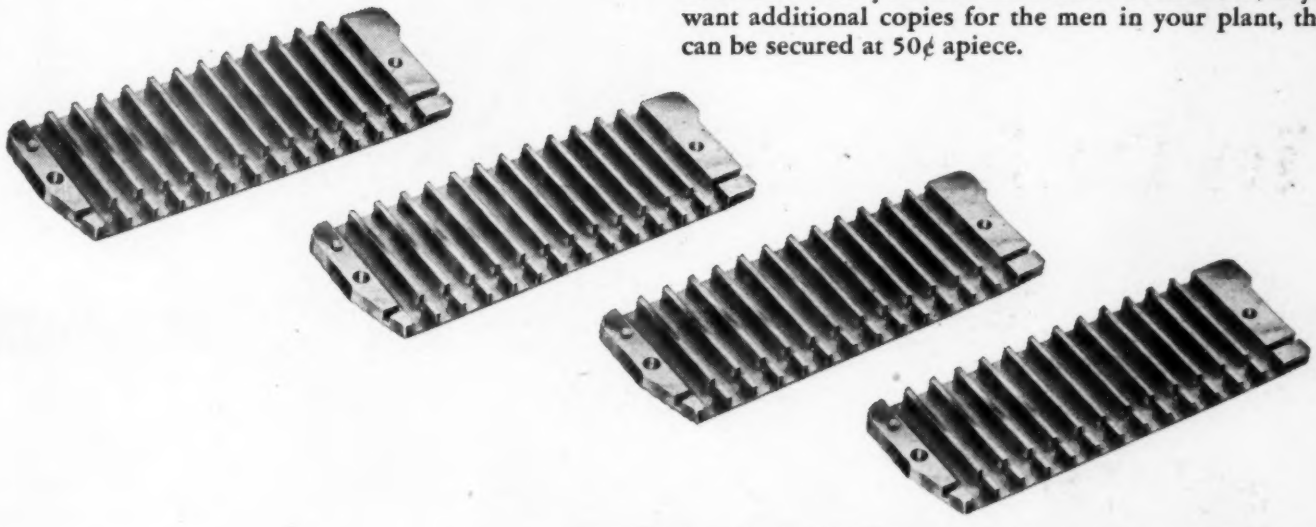
Here is a way to keep your Stainless machining costs in line, even when jobs are intricate and tolerances close.

Helping you to machine parts from Carpenter Stainless at less cost is as much a part of our work as the making of uniform, easy-cutting Stainless Steels. So whenever you run up against a problem of selecting and working with the Stainless that will do your job best, make full use of our experience. Your nearby Carpenter representative can give you personal help in the shop and supply you with printed information to help you shave costs on each Stainless machining operation. For example . . .

Here's Complete Information To Help You Machine Stainless Steel At Less Cost . . .

This NOTEBOOK contains useful information, much of it never before published. It will give you hints to take the kinks out of Stainless machining jobs, reduce rejects and cut costs. In each chapter you'll find a complete Check Chart that lists common "trouble spots", and gives shop tips on how to cure them.

Your nearby Carpenter representative will be glad to give a personal copy of the "NOTEBOOK on Machining Stainless Steels" to Production and Management Executives. And after you have used the NOTEBOOK, if you want additional copies for the men in your plant, they can be secured at 50¢ apiece.



THE CARPENTER STEEL COMPANY, 109 W. Bern St., Reading, Pa.

Carpenter

FREE-MACHINING

STAINLESS STEELS

PROMPT SHIPMENT FROM CONVENIENTLY LOCATED STOCKS

Buffalo	Cleveland	Hartford	Philadelphia
Chicago	Dayton	Indianapolis	Providence
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Already a Sensation . . .

32 Alundum*

The New Norton Abrasive

It's Cutting Grinding Costs in Plant after Plant, *Because...*

32 ALUNDUM* is an entirely new type of electrically fused aluminum oxide abrasive.

It's radically different in shape and in appearance.

It's made differently by a Norton invented and patented process.

Each super-cutting grain is a single crystal—individually produced in the electric furnace—not crushed to size.

It's the first and only abrasive with a sharp, nubbly surface for a super cutting action.

It's the only abrasive which combines a strong grain structure with a cool cutting action.

Cuts deeper and faster

Cuts freer without burning

Requires fewer dressings

Gives longer wheel life

STOCK WHEELS AVAILABLE NOW FOR SURFACE, TOOL AND INTERNAL GRINDING — OTHER TYPES SOON

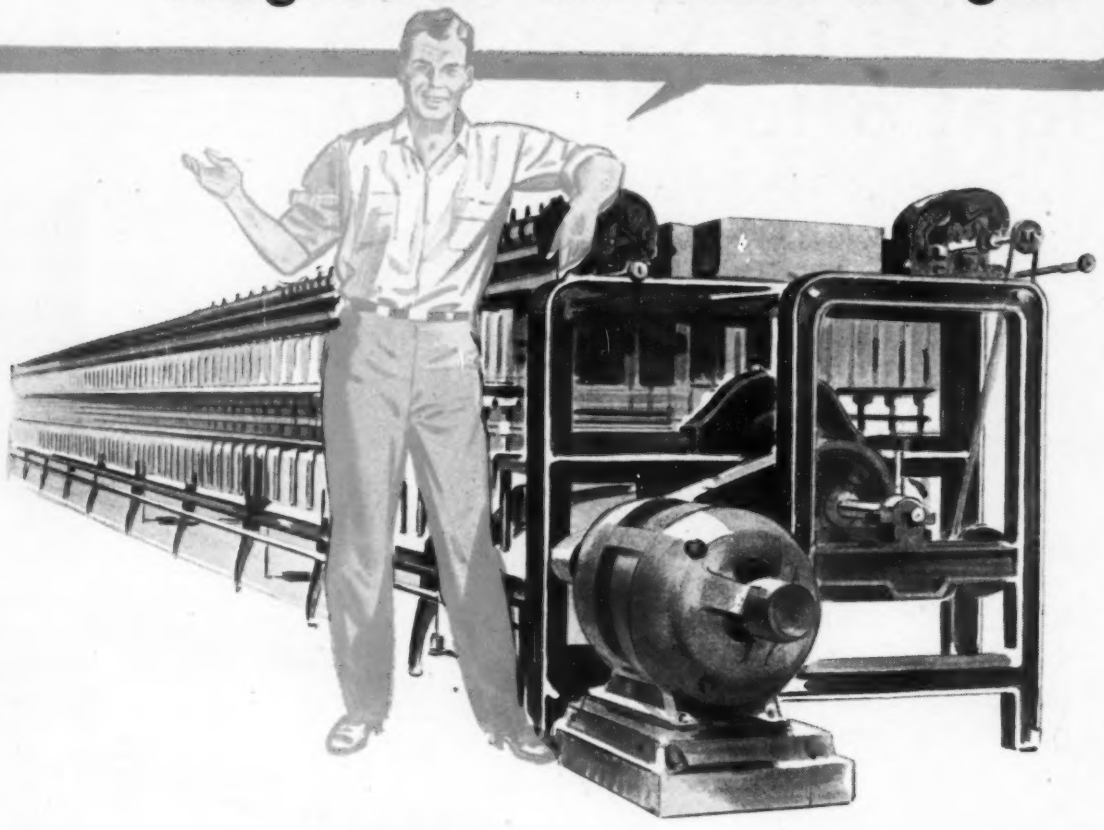
Write for additional information or, better still, call in your Norton abrasive engineer or Norton distributor.

NORTON COMPANY • WORCESTER 6, MASS.

Distributors in All Principal Cities

NORTON ABRASIVES

"I want to be sure Magnesium will stand the gaff"



Right you are, Mr. Plant Operator, in wanting assurance that the magnesium going into your machinery and equipment can take the punishment you'll give it. Here's a sample of such evidence—

You saw magnesium "take bumps a'plenty" during the war. Planes used millions of pounds of American Magnesium products where dependability was paramount.

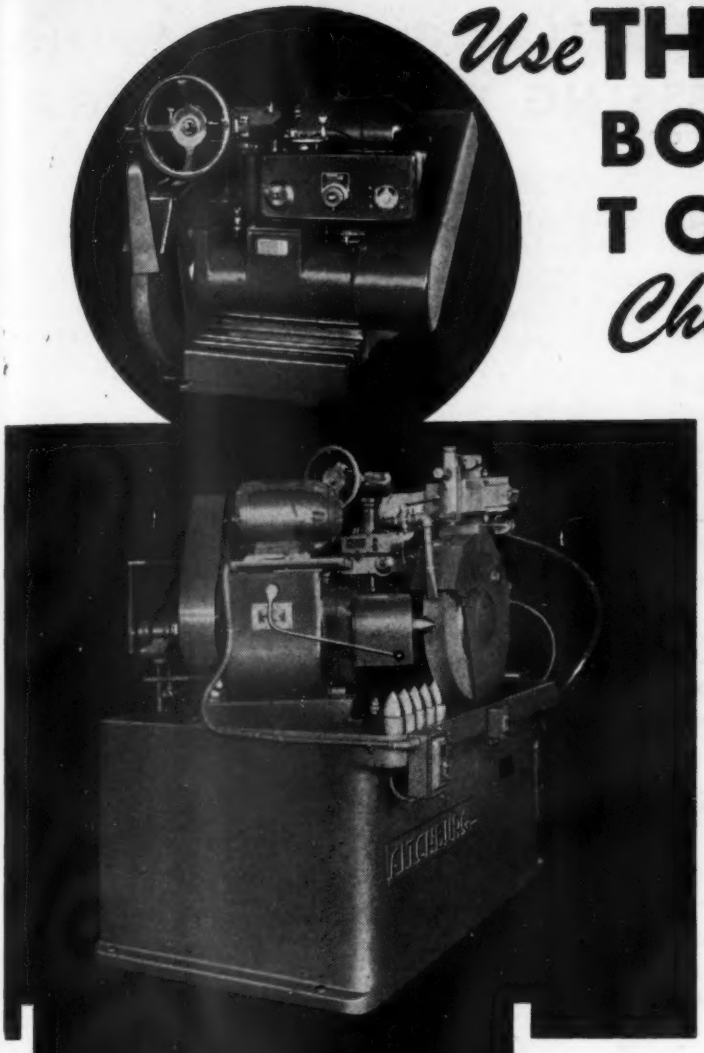
At home, in industry, high-speed knitting machines turned out greater quantities of materials because of their lightweight American Magnesium parts. Wrapping machines, food preparation equipment, and the like, with magnesium parts—all stood the terrific strain of day and night operation throughout the war years. And they're still going strong.

Yes, magnesium can take it. So, if you're interested in speeding up your equipment by incorporating this efficient, dependable weight saver, get in touch with the nearby Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, Sales Agent for American Magnesium Products, 1709 Gulf Building, Pittsburgh 19, Penna.

MAGNESIUM MAZLO PRODUCTS

REG. U.S. PAT. OFF.

AMERICAN MAGNESIUM CORPORATION
SUBSIDIARY OF
ALUMINUM COMPANY OF AMERICA



Use THE FITCHBURG BOWGAGE HEAD TO GRIND IT *Cheaper, faster, better*

Just as multiple tooling and combined cuts increased production profits of machined work in mass production, the Fitchburg method of precision grinding cuts additional cost factors from every piece, saves on production and equipment.

Designed on an entirely new principle of precision grinding, the Fitchburg head is a completely self-contained and independent grinding unit. It may be installed singly or in multiples to operate simultaneously or consecutively in mass production. It also may be installed to modernize any equipment.

Get the facts — you will instantly make a favorable comparison between Fitchburg Automatic Precision grinding and any other method. Install a Fitchburg now, and use your "Head" to cut costs and speed production. Send your blueprints for our engineers' recommendations — there's no obligation.

THE HEAD. *The Bowgage Head* is a completely independent precision grinding unit. It has rapid traverse, slow grinding feed, grinding dwell or spark out, and rapid return to starting position — all started by one push button. It is precise to .0002", minimizing spoilage. It can be removed and remounted for other work, if operations are changed.

THE BODY. *This Fitchburg Single-Head Ojive Grinder,* designed to grind the ojive of the 75 MM armor piercing shell, is typical of Fitchburg cut-cost production. The wheelhead, carrying a 24" x 3½" face wheel, is completely automatic. It is mounted with a hydraulic form trueing device to true the face of the grinding wheel at the proper radius for the nose of the shell. The workhead is equipped with a parallel-motion jaw-chuck, operated by a hydraulic cylinder at the back of the workhead.

Write Today for Catalog—Sent Free Upon Request

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

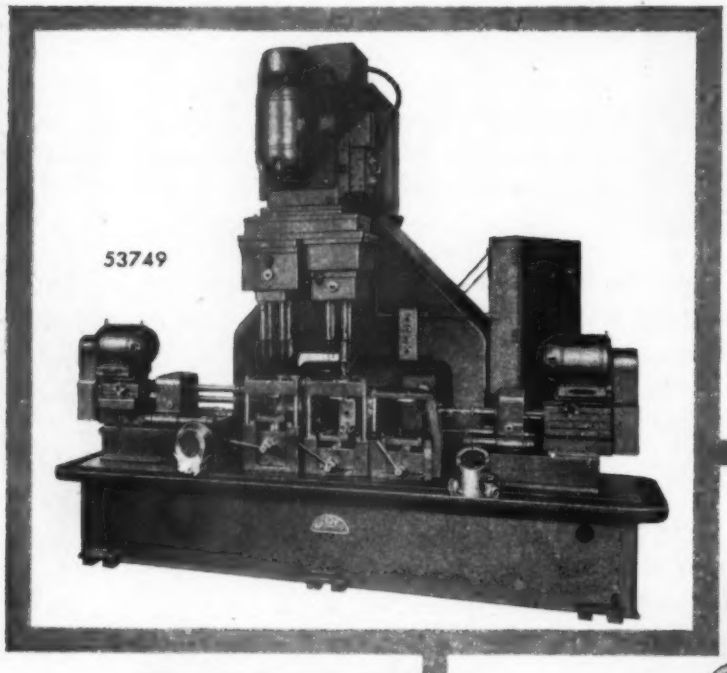
SNYDER 4-WAY SPECIAL DRILLING AND TAPPING MACHINES FOR PROCESSING PUMP HOUSINGS

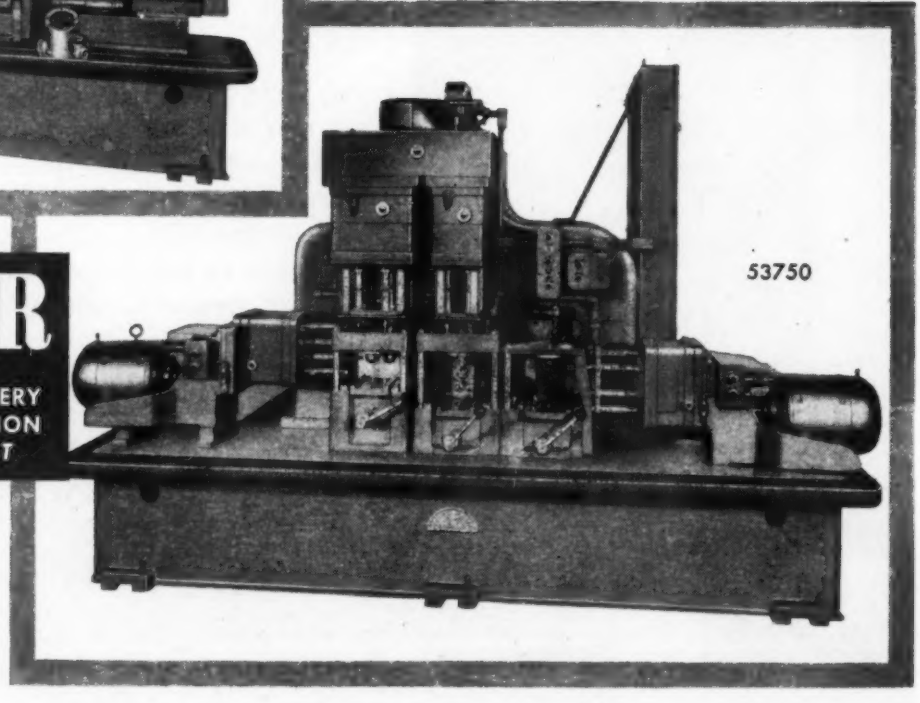
Objective of the companion special drilling and tapping machines shown below is the rapid and economical processing of pump case parts used by one of the country's leading pump manufacturers. Without sacrifice of special-machine efficiency, the two 4-Way Snyders incorporate provision for alterations and changes in work piece design. Each machine processes simultaneously work pieces of dissimilar size and shape.

Three quick-clamping fixtures on each machine accurately position work for drilling and tapping action from seven separate multiple heads. The first fixture accommodates one housing, while the second and third fixtures each clamp a second housing in a different position. Multiple heads are driven from standard self-contained hydraulic power units and are operated in a cycle by push-button control.

Substantial economies are expected as a result of simplified and unified design of all machine elements. Mounting of power units and fixtures on the common horizontal plane of the machine table permits easy adaptation to product changes, and restricts the corresponding machine changes to the multiple head and fixture immediately concerned. Multiple heads are designed in individual spindle groups in order to accommodate changes in the design of work parts. Both machines are excellent examples of the versatility and efficiency characteristic of well-engineered specials.

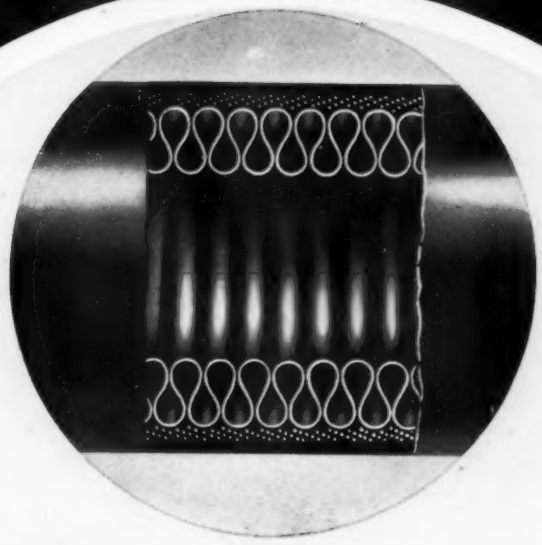
In numerous applications such as these, specials offer advantages beyond the scope of standard machines. The special, for example, brings fast automatic operation, simplified handling, and lowered operator fatigue as a solution to the current problem of diminishing worker productivity. Also, in your shop, as in many others, the higher production rates, superior control of accuracy, finish and time cycle possible with special machines may be of critical importance. Check this possibility with us. *Snyder Tool and Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.*





SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

21 Years of Successful Cooperation with Leading American Industries



Flexible ASSEMBLIES

FOR HIGH VACUUM DUTIES . . . .

In molecular distillation, and for certain electronic applications, a vacuum as high as one-tenth of one micron is not at all uncommon. That starts to get pretty close to the theoretical "perfect" in vacuum language. The problem of piping, however, is another matter for engineers, especially wherever flexible connections are needed for such purposes as coupling mechanical pumps to the system being evacuated.

American Flexible Bronze Seamless Tubing has turned out to be an excellent solution to the problem for various reasons: first, being absolutely seamless it is fully capable of holding such high vacuum; second, because it is uniformly corrugated it offers extreme "bend-ability" providing simplicity of installation; third, since it possesses such flexibility it becomes an absorber preventing transmission of pump vibration to the vacuum system. In addition, American Seamless can be assembled to withstand unusual abuse and will serve long and dependably with a minimum of maintenance. Because of its construction, American Seamless can take up slight expansion and contraction, thus making it possible to maintain pumping speed — an important consideration in pulling a vacuum.

American Seamless Flexible Metal Tubing can be supplied in many styles from the simplest unbraided flexible tube to a rugged wire braided assembly with molded-on synthetic covering such as shown above.

Where the requirements for a flexible vacuum or suction line are somewhat less exacting — such as for sucking away fumes, chips or light dry materials — *American* manufactures other styles of Flexible Metal Hose from practically any workable alloy and in sizes ranging from ½" to 12" inside diameter.

The whole story is given in our catalog, a copy of which will be sent on request. Specific information on industrial applications is given on the reverse side of this sheet.

46338

American Metal Hose

THE AMERICAN BRASS COMPANY AMERICAN METAL HOSE BRANCH

General Offices: Waterbury, Conn. Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA

Engineered

FOR SPECIFIC INDUSTRIAL APPLICATIONS

STEAM LINES

Full-interlocked bronze for toughest steam hose requirements, sizes up to 8″ I.D.; extra flexible wire-braided steam hose where extreme "bend-ability" needed, sizes to 1¼″ I.D.; seamless flexible bronze steam hose for connecting moving parts, sizes to 4″ I.D.

OIL LINES

Full-interlocked galvanized steel for hot tar or asphalt, road oils, unloading fuel oil, etc., sizes up to 8″ I.D.; extra-flexible wire-braided steel for high pressure grease lines; oil feed and coolant lines for machine tools; seamless for lubricating moving parts.

AIR AND GAS LINES

A complete line of flexible connectors for carrying air and gases (propane, butane, manufactured, natural, hydrogen, oxygen, acetylene and others) is available in a full range of sizes and in various alloys.

CHEMICAL LINES

Distilleries, filter press manufacturers, medical and chemical firms regularly use *American* for handling or transferring chemicals.

CONDUITS

A full line of conduits for covering electrical wiring on domestic appliances, machine tools, etc. can be furnished in brass, bronze, stainless, aluminum or galvanized steel.

VIBRATION ABSORBERS

Where compressor or pump vibration constitutes a serious menace to rigid piping, a short section of American Seamless absorbs the vibration, eliminates possible trouble. Likewise on Diesels, *American's* flexible exhaust hose takes up vibration, prevents shearing of bolts, cracking of castings.

MISALIGNMENT CONNECTORS

Assembling components of heavy machinery, such as sectional boilers, oftentimes can be accomplished more quickly and more economically where tappings are slightly out of line — American Seamless does the trick.

CONNECTORS FOR MOVING PARTS

Wherever moving parts of machinery must be heated with steam, cooled with water, or lubricated, no better way has been found than to convey the heating, cooling or lubricating agent through Flexible Metal Tubing.

American Metal Hose

THE AMERICAN BRASS COMPANY — AMERICAN METAL HOSE BRANCH

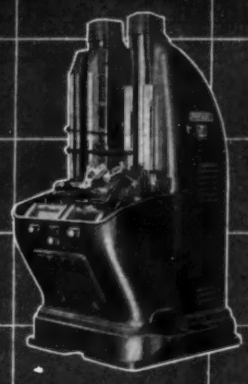
General Offices: Waterbury, Conn. Subsidiary of Anaconda Copper Mining Company

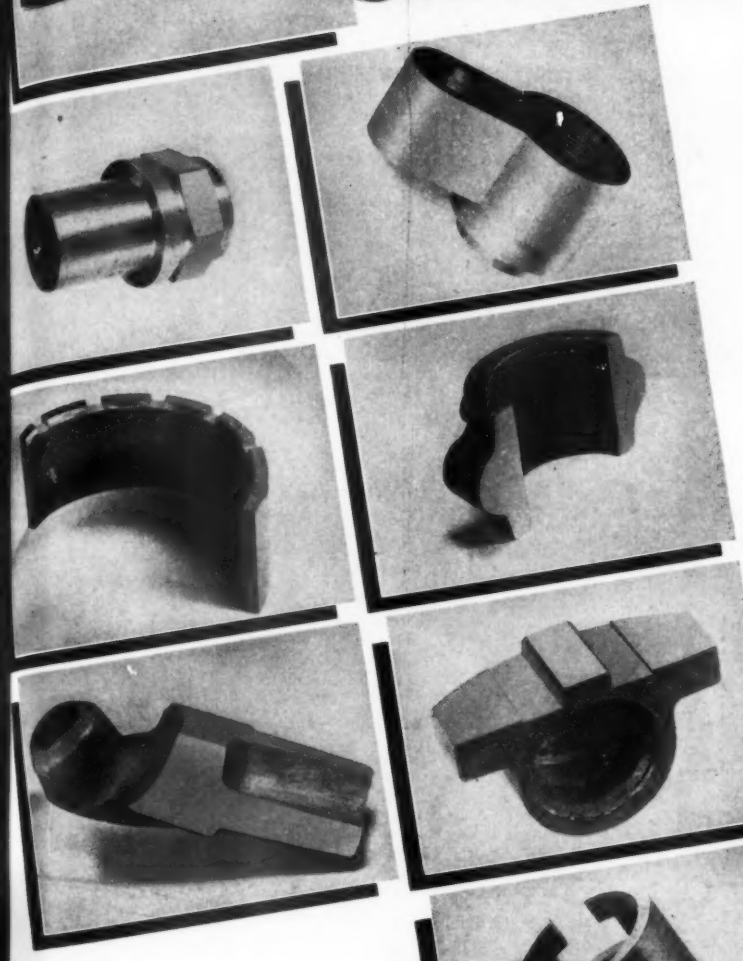
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA

from mine to consumer

HOW TO CUT PRODUCTION COSTS ...THRU *Surface Broaching*





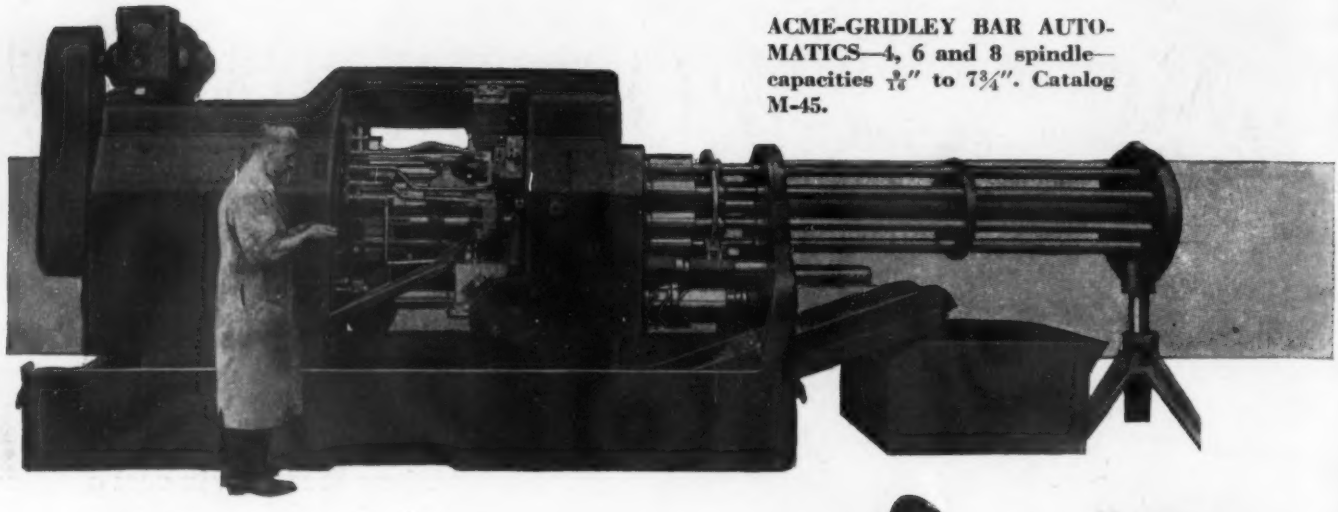
★ Wherever metal is removed on duplicate small parts you are apt to find a place where Footburt Surface Broaching Machines can cut manufacturing costs. Production is high, parts can be machined to very close tolerances and tool maintenance is low in cost per piece. We have had many years of experience in designing the tooling for various types of parts and will gladly advise you in applying surface broaching to your work.

THE FOOTE-BURT COMPANY
CLEVELAND 8, OHIO
Detroit Office: General Motors Building

Footburt Patented Tooth Form

FOOTBURT *Surface Broaching*

TIME IS VITAL IN



ACME-GRIDLEY BAR AUTOMATICS—4, 6 and 8 spindle—capacities $\frac{9}{16}$" to $7\frac{3}{4}$". Catalog M-45.

ACME-GRIDLEY CHUCKING AUTOMATICS—4, 6 and 8 spindle—capacities $4\frac{5}{8}$" to 12". Bulletin CM-43.

ACME-GRIDLEY SINGLE SPINDLE CHUCKMATIC—compact, easy to operate on high-speed precision work. 12" capacity. Bulletin SC-46.

ACME-GRIDLEY BAR AND CHUCKING AUTOMATICS MAINTAIN ACCURACY AT THE HIGHEST SPINDLE SPEEDS AND FASTEST FEEDS MODERN CUTTING TOOLS CAN WITHSTAND

TODAY'S MANUFACTURING

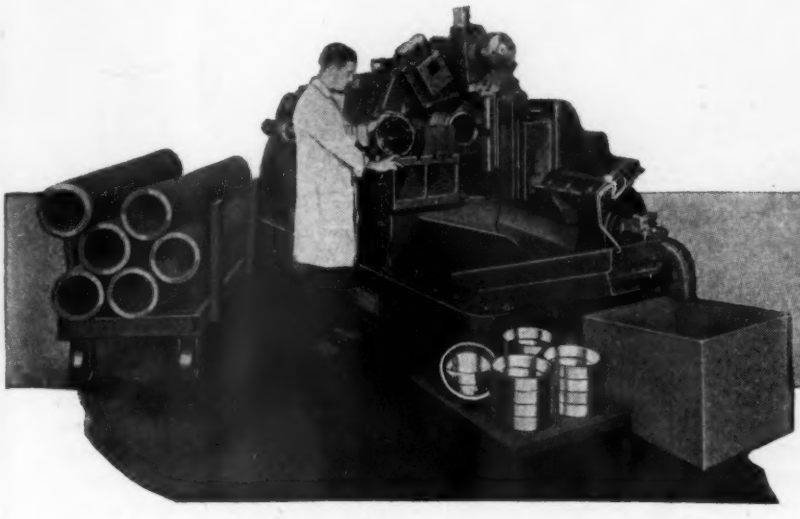
Material costs and hourly wage rates tend to equalize for all manufacturers, and both tend to rise.

The one controllable factor is TIME.

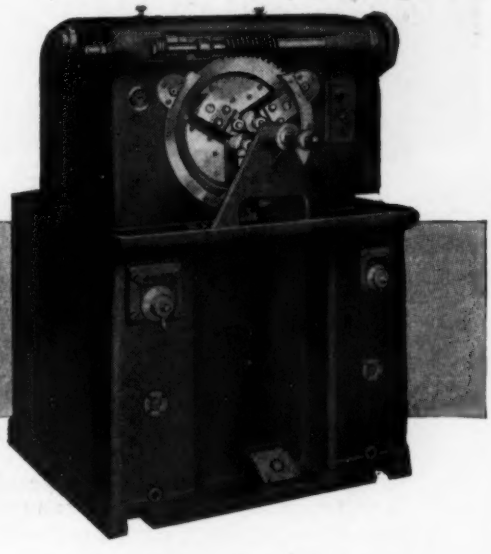
Here at National Acme, we have thousands of examples of cutting machine time 20% to 70%—examples from actual production records.

We'll gladly send you Bulletins on any of the automatics shown here, or give you machine time estimates on your particular work.

Write us for help in getting your costs down and keeping them there—with Acme-Gridley modern production methods.



ACME-GRIDLEY 12" SINGLE SPINDLE BARMATIC—making new production records on the larger bars and tubing. Bulletin M-47.



NAMCO HYDRAULIC THREAD AND FORM ROLLING MACHINE. Capacities 3/8" to 1½". Bulletin TR-45.

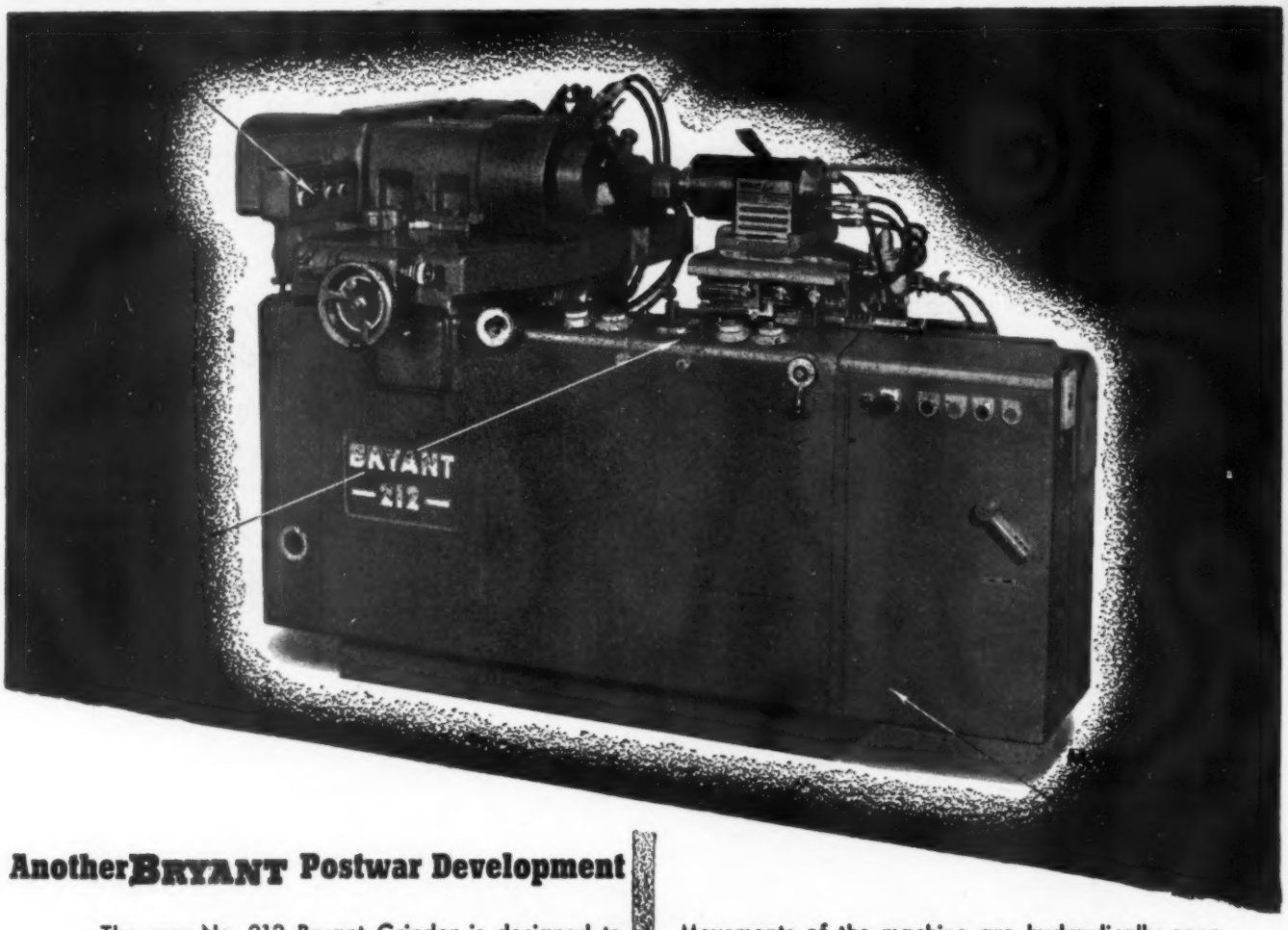
The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog-Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

Announcing a New Automatic High Production Internal Grinder

No. 212



Another BRYANT Postwar Development

The new No. 212 Bryant Grinder is designed to fill the pressing need for greater production per man hour. It is a fully *automatic* internal grinder that requires a minimum of operator attention—in fact on many jobs one man can run two machines. Production is higher, more precise and more profitable with this new grinder.

The new No. 212 Bryant roughs and finishes bores from 5/16" to 6" (approx.) in diameter in lengths up to 3 inches. On the smaller bores, it is especially suited to the use of *Bryant High Frequency wheel spindles which operate at speeds up to 100,000 r.p.m.*

The No. 212 design incorporates the superiority of Bryant three point wheel slide suspension and insures maximum rigidity under all conditions. Movements of the machine are hydraulically operated, while the cycle is controlled electrically to facilitate change-over. Sizing is accomplished accurately and automatically by any one of three methods: a plug gage mounted in the work spindle, a diamond tipped bore contact, or controlled by the wheel truing diamond. It *roughs* and *trues* and *finishes* and stops *automatically*—producing parts with fine work finish to tolerances that insure bores that are straight and round, making the products which you manufacture more desirable because they run smoother and live longer.

If grinding figures in your production plan, your move for best results is to—

SEND For The Man From Bryant.

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

We certainly don't expect you to join our growing list of customers *unless* we can give you better abrasive products for *your particular production jobs* . . . plus better service.

Our rapid growth in ten years from one of the smallest makers of abrasive products to one of the largest, didn't just happen. Company after company found we could help them get better production, lower costs . . . and give them better service. That's how we built our business.

Should you use MID-WEST abrasives? The only way we know for finding out is for you to give us a trial. It's worth it . . . if you're looking for better production, lower costs, and better service. Call us. We'll cooperate.

James Jackson
PRESIDENT

MID-WEST ABRASIVE COMPANY

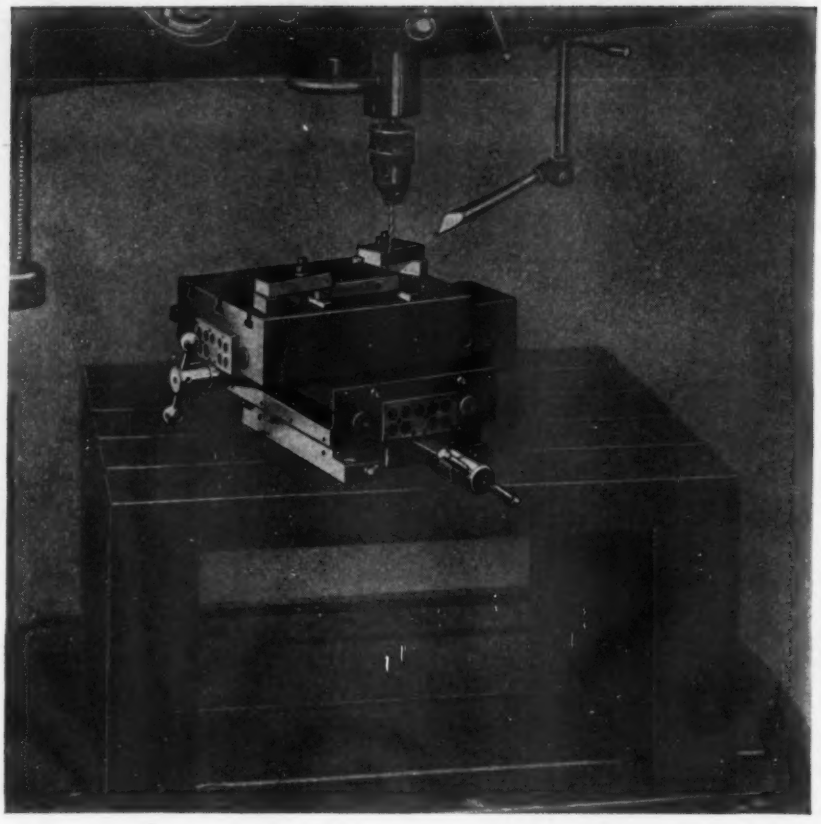
OWOSSO, MICH. DETROIT ROCHESTER, PA.

GRINDING WHEELS HONING STONES COATED ABRASIVES

NOW . . .

without JIGS

. . . . *you can drill, bore, ream and tap . . . small work*

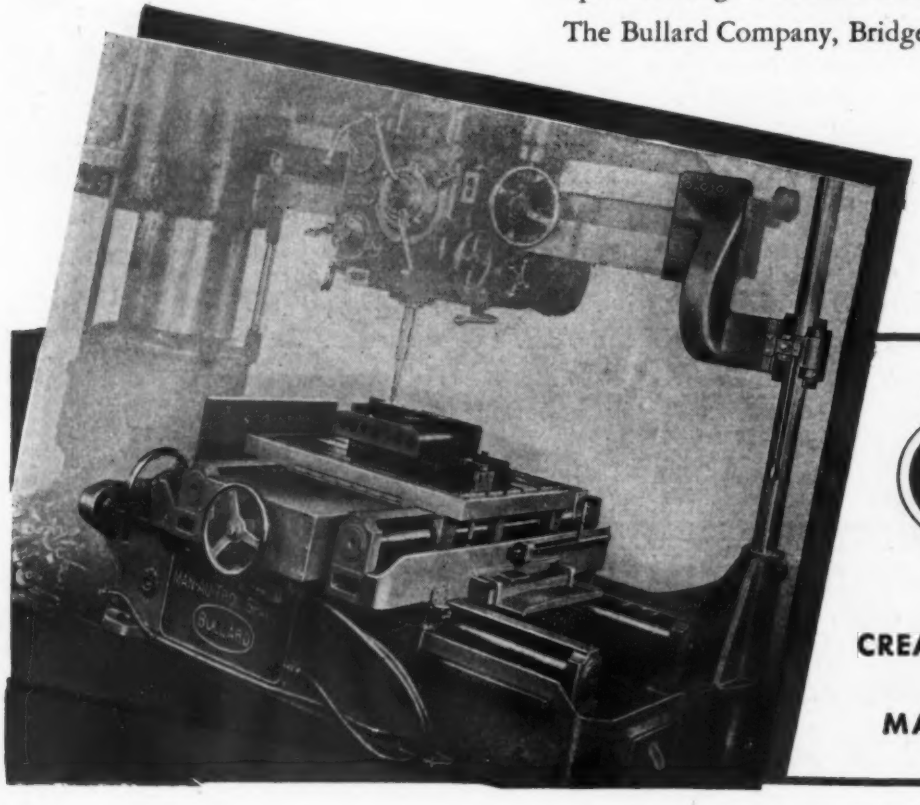


The new 4″x 4″ Bullard MAN-AU-TROL Spacer for speedily and accurately locating holes within a 4″x 4″ area . . . for use on smaller sensitive drills but usable on larger drills as shown. Its hydraulic unit will operate four 4″x 4″ Spacers if you so desire.

. . . as well as
LARGE WORK

The new 30″x 20″ Bullard MAN-AU-TROL Spacer for accurately repeating a pattern of holes within a 30″x 20″ area . . . for use on radial drills.

BOTH the 4″x 4″ and 30″x 20″ Bullard MAN-AU-TROL Spacers give you such benefits as: elimination of expensive jigs . . . no production tie-ups for making jigs . . . straight holes 90° to the work . . . prevention of strain on drill spindle and reduction of drill wear because of perfect tool centering . . . less operator fatigue. Write for MAN-AU-TROL Spacer Bulletin. The Bullard Company, Bridgeport 2, Connecticut.



Typical Installation of 30″x 20″ MAN-AU-TROL Spacer.

BULLARD

CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

"Put it on the Blanchard"

Here is another example of how the BLANCHARD increases the production of these sprocket shaft supports over the former method.

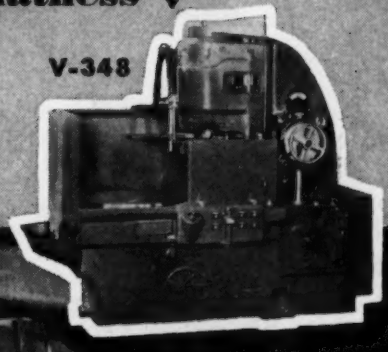
These steel forged sprocket shaft supports are ground on a No. 18 Blanchard Surface Grinder equipped with a 36" chuck. Four pieces are placed on the chuck at one time and 1/8" to 3/16" of metal is removed from each surface.

They are ground at the rate of 10 per hour, whereas only 2½ pieces were produced per hour by the former method of production.

When surfaces must be flat and parallel, "put it on the Blanchard" and increase production.

GET THESE ADVANTAGES

- Production ✓
- Adaptability ✓
- Fixture Saving
- Operation Saving
- Material Saving
- Close Limits
- Fine Finish
- Flatness ✓



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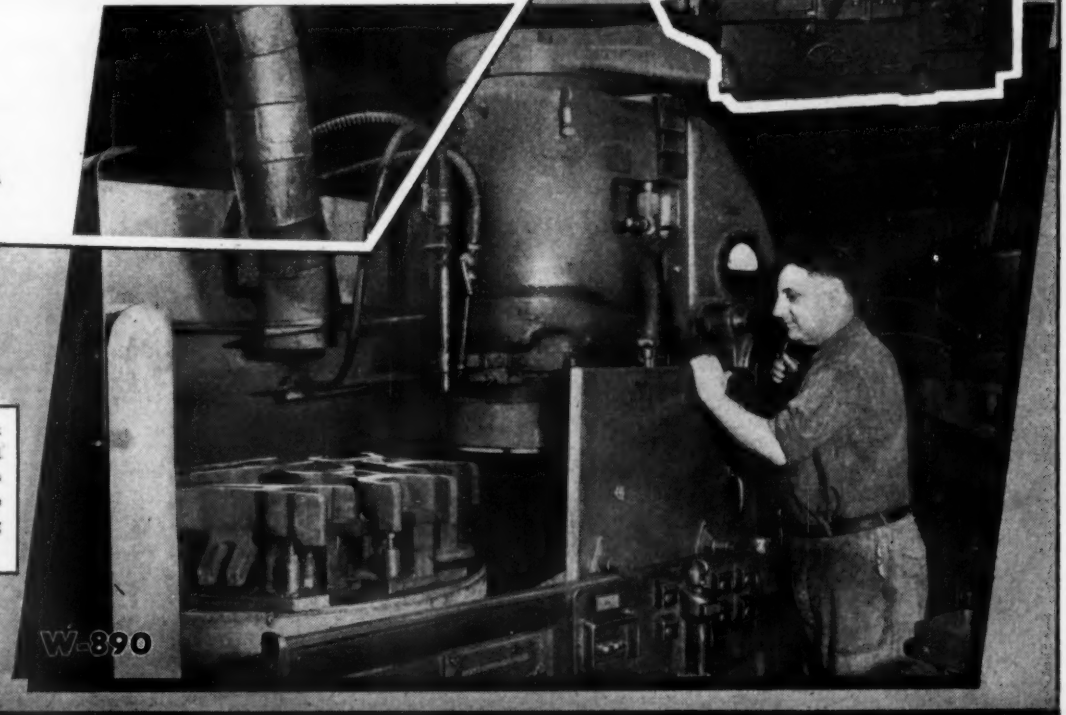


W-890

Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

FOR TODAY'S *Tougher Jobs* ...

Where It's Wet

Even the toughest, wettest weather doesn't bother the new totally enclosed Tri-Clad motors. Cast-iron end shields are machined to provide a tight seal. Motor leads are sealed in a nonshrinking compound. Long, close-running fits, and a rotating labyrinth seal, keep moisture from entering the motor along the shaft.

Where It's Corrosive

Acids, alkalis, corrosive fumes, and vapors are kept out of these sturdy new Tri-Clads by tight joints treated with special sealants. Corrosion-resisting screws hold conduit-box covers tightly. Tough Glyptal* paint gives protection from corrosion.

Where It's Dirty

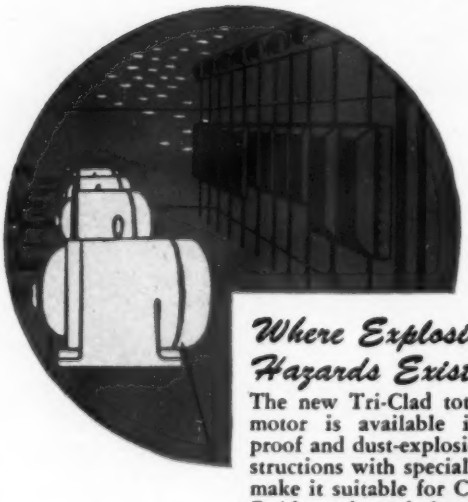
Dirt and dust that cut motor efficiency and shorten motor life can't get into these sealed, totally enclosed Tri-Clad motors. Smooth easy-to-clean surfaces and rounded contours enable these Tri-Clads to look good even in dirty surroundings.

Where Iron Dust Flies

Harmful iron dust and metallic filings can't get past the inner wall of these new Tri-Clads. Bearings are safe from gritty dust in cast-iron housings cast integral with end shields. Long, close-running fits and a rotating labyrinth seal stop dust infiltration along the shaft.

Where Space Is Tight

When space is limited for a totally enclosed motor, you'll appreciate the trim, extra compactness of the new Tri-Clads. A diagonally split conduit box, mounted on either side of the frame, adds little to over-all motor width. These motors do a big job in a little space.



Where Explosion Hazards Exist

The new Tri-Clad totally enclosed motor is available in explosion-proof and dust-explosion-proof constructions with special features that make it suitable for Class I, Group C (through 15 hp) and Group D, and Class II, Groups E, E, and G, locations. All sizes tested and listed by Underwriters' Laboratories, Inc. Also in Bureau of Mines construction (Schedule 2E).

• HERE'S A NEW *Tougher Motor*

THE G-E TRI-CLAD TOTALLY ENCLOSED MOTOR

1 to 1000 Hp

Enthusiastic reception of the Tri-Clad open motor, with its *extra protection* features, proved that industry was waiting for a motor with protection built in. And, since 1940, more Tri-Clad motors have gone into service than any other integral-horsepower motor.

Now General Electric is ready with a new line of Tri-Clad motors—totally-enclosed, fan-cooled motors—the toughest motors we've ever built.

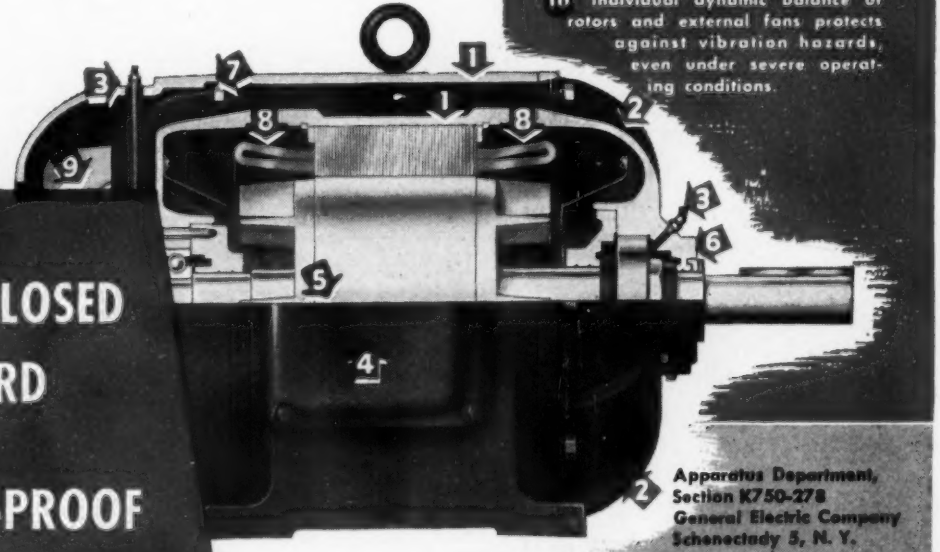
These new Tri-Clads are designed and built specifically for use in many adverse atmospheres—in iron dust, out of doors, in hazardous areas, and chemical atmospheres. *We believe that they are industry's most dependable motors.*

Their scope of application is as wide as the field of industrial motor use. Safeguarded against most sources of motor damage, their longer life and lower maintenance will make them a sound investment on almost every job.

**Trade-mark Reg. U.S. Pat. Off.*

10-POINT PROTECTION

1. A cast-iron, double-wall frame completely encloses and protects the windings and punchings.
2. Corrosion-resistant cast-iron end shields are machined to provide a tight seal, and protect the motor from dust, dirt, and moisture. Primer and finish coat of protective Glyptal affords high rust-resistance.
3. A pressure-relief greasing system, which can be packed with long-life lubricant, protects the bearings.
4. The cast-iron conduit box is diagonally split for easy wiring. Boxes are independently explosion-proof on Class I motors.
5. Nonshrinking compound around motor leads protects motor interiors from dust and moisture at the point where leads pass through the frame.
6. Rotating labyrinth seal further protects motor interior from damage by foreign matter.
7. Large air passages provide adequate protection from overheating. Easy to keep clean and open, too.
8. Modern, "ageless" insulation treatment includes windings of Formex* magnet wire.
9. Removable external fan is of the nonsparking type in explosion-proof motors.
10. Individual dynamic balance of rotors and external fans protects against vibration hazards, even under severe operating conditions.



TOTALLY ENCLOSED STANDARD and EXPLOSION-PROOF MOTORS

FOR THE COMPLETE STORY

Apparatus Department, Section K750-278
General Electric Company
Schenectady 5, N. Y.

Please send me GEA-4400, which describes the new Tri-Clad totally enclosed motors. Please send me GEA-4131, "Motors and Control for Hazardous Locations."

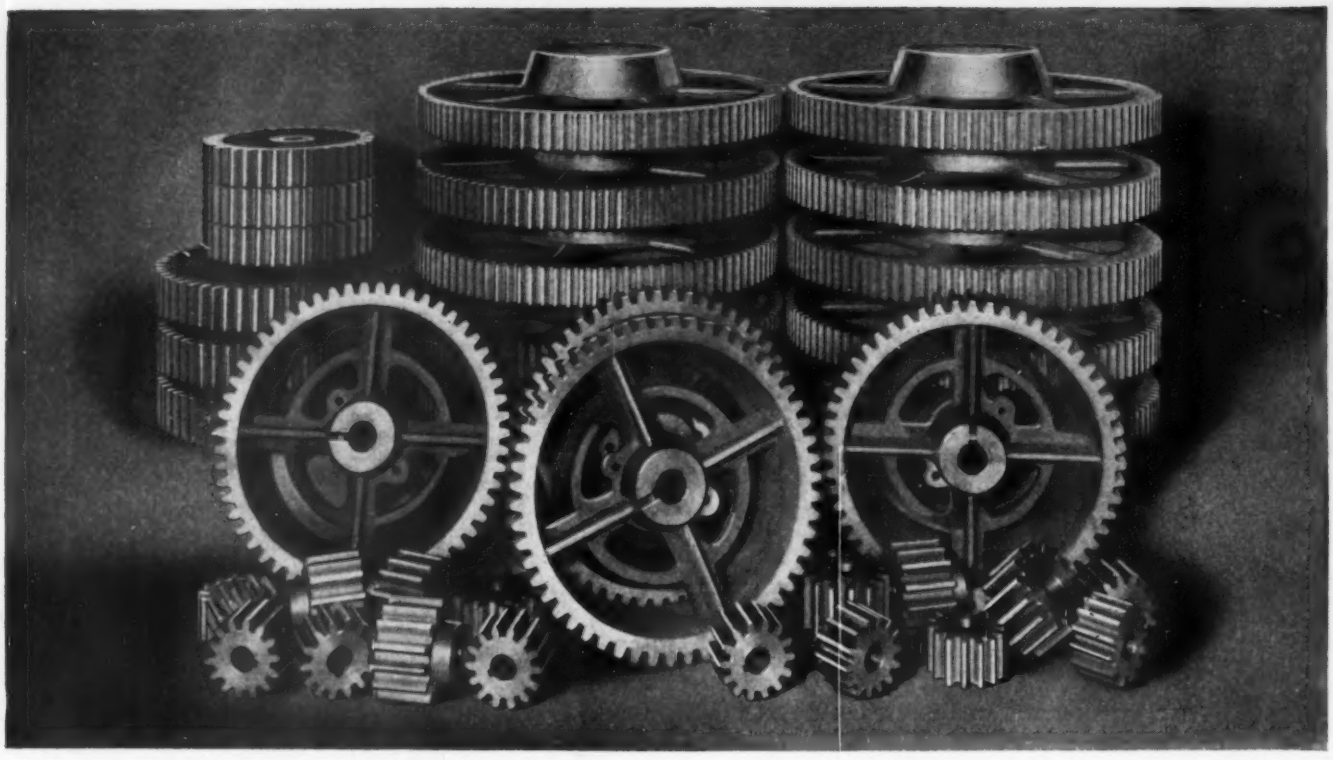
NAME.....

COMPANY.....

ADDRESS.....

GENERAL ELECTRIC

760-278-8080



GEARS

MADE TO YOUR SPECIFICATIONS

Before you buy stock Gears find out the benefits to you through the purchase of Gears made specifically for your requirements.

Our experienced gear experts will be glad to confer with you relative to your gear problem.

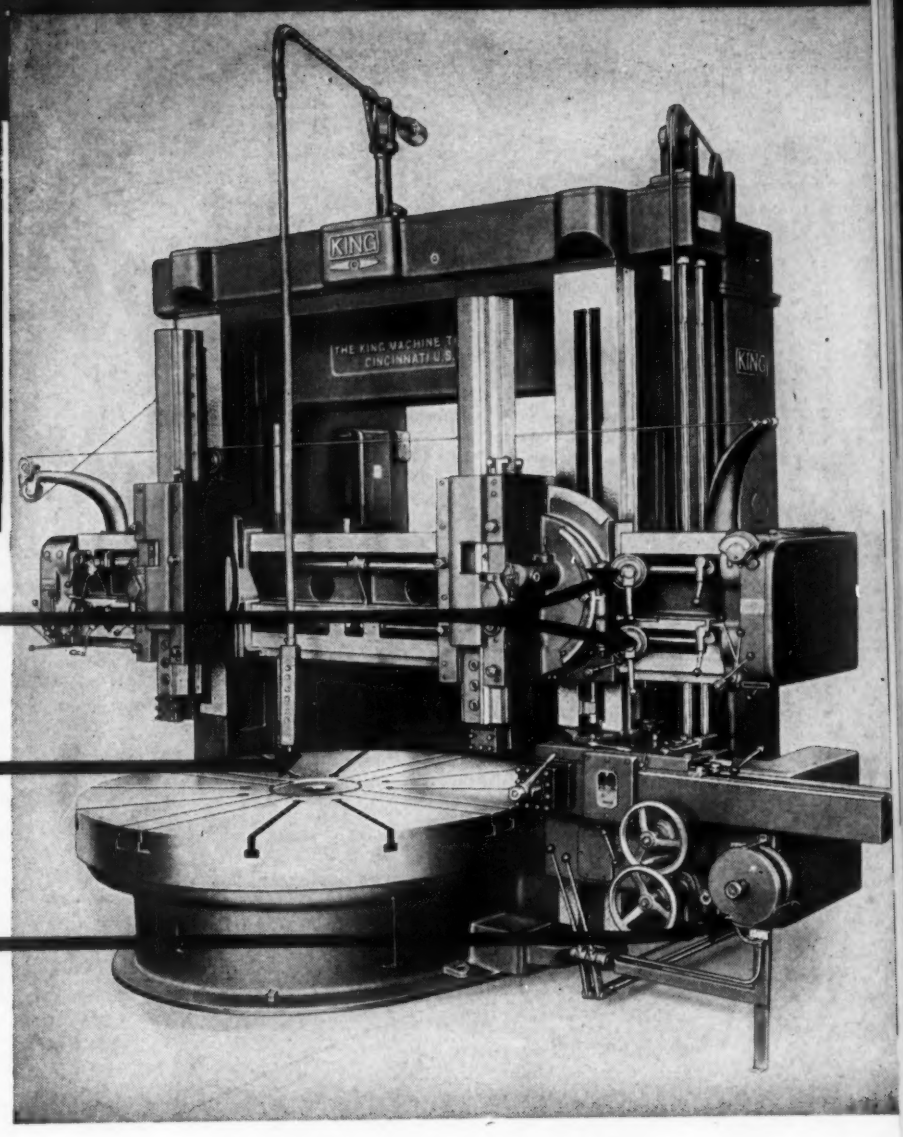
SPUR GEARS
HELICAL GEARS
BEVEL GEARS
MITRE GEARS
INTERNAL GEARS
WORMS
WORM GEARS
SPROCKETS
RATCHETS
SPLINED SHAFTS
RACKS
SEGMENT GEARS
LEAD and FEED SCREWS

The **ADAMS COMPANY**
DUBUQUE, IOWA
ESTABLISHED 1883

Simplified Control provides ease of operation on the New Series

KING

Vertical Boring and Turning Machine



HAND CONTROL LEVERS

Hand Control Levers for horizontal and vertical adjustments are a part of the head and travel with the head toward the work.

THE PENDANT SWITCH

The Pendant Switch may be swiveled to any convenient operative position and gives operator control of table. If desired, control of rapid traverse, rail elevating and other unit control can be included.

D. C. ADJUSTABLE MOTOR DRIVE

D.C. adjustable motor drive may also be built in if desired, and provides a wide range of table speeds instantly available without stopping the table.

● These are a few of the many improvements incorporated in the new series King Vertical Boring and Turning Machine. This machine is of noticeably heavier construction—has rigidity and power to get the most out of carbide cutting tools—new rectangular type ram head with four gibs and eight bearing surfaces assures maximum rigidity and support to cutting tool.

The New Series King Vertical Boring and Turning Machines are available in ten sizes: Single Column Type 30", 36", 42". Double Column Type 52", 62", 72", 84", 100", 120" and 144".

THE KING MACHINE TOOL COMPANY

CINCINNATI 29, OHIO

BUILDERS OF VERTICAL BORING AND TURNING MACHINES

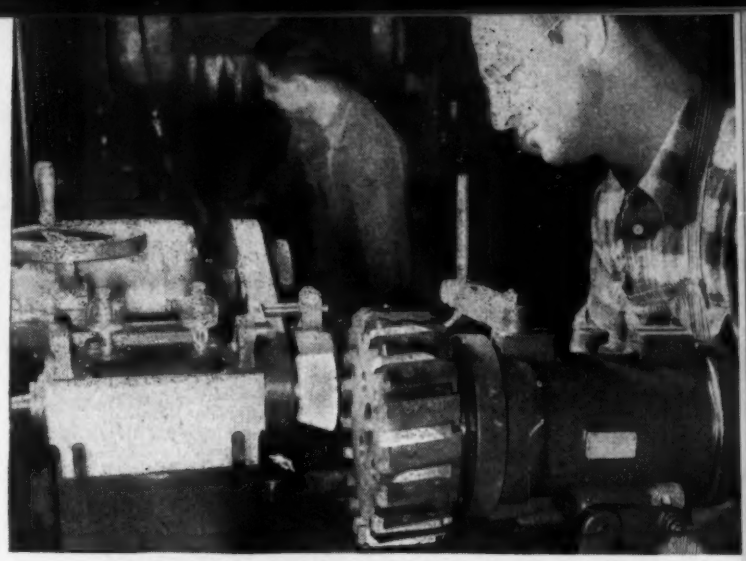
The No. 10 Makes it to SAVE on CUTTER

Designed for operation from front of machine. Controls and adjustments on the No. 10 are all within easy, natural reach. Vertical adjustment handwheel is centered immediately above on the spindle head.

B·S

BROWN &

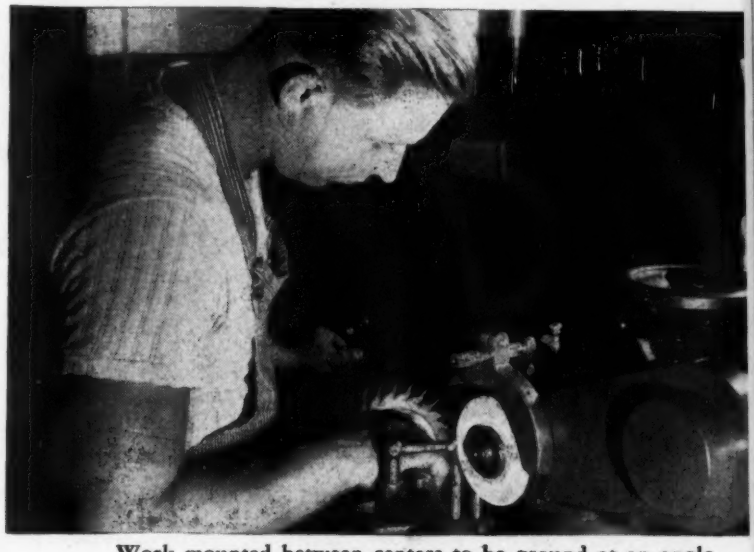
EASY SHARPENING



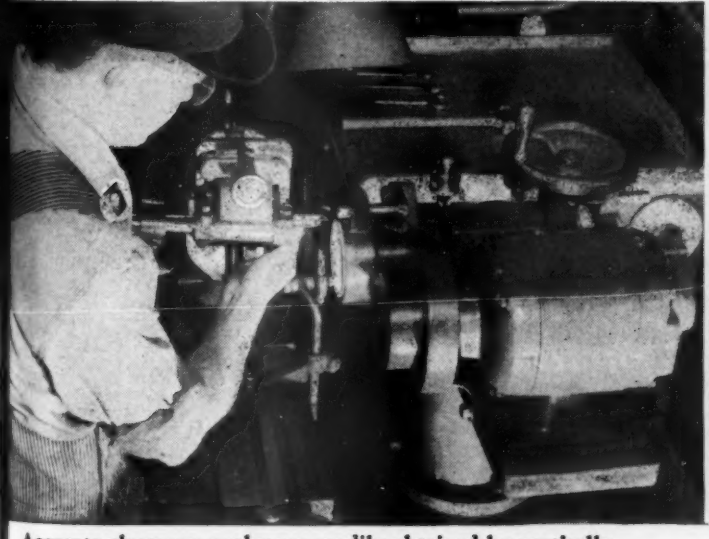
Many available attachments broaden the scope of this general cutter grinding machine. The Face Mill Sharpening Attachment for example (shown above) permits face mills up to 14" diameter to be sharpened.

With the No. 10 it is easy to sharpen tools rapidly and accurately at savings in time and money. You'll get more production out of correctly sharpened tools . . . longer tool life . . . and the tools will spend more time cutting and less time being sharpened.

The No. 10 Cutter and Tool Grinding Machine is designed specifically for the rapid, accurate sharpening of plain milling cutters (straight and helical), formed cutters, straddle and face mills, angular cutters of any angle, side milling cutters, end mills, straight or tapered reamers and saws. Other types of grinding, such as internal, straight and taper cylindrical are readily handled by means of additional equipment. Write for descriptive literature. Brown & Sharpe Mfg. Co., Providence 1, R.I., U.S.A.



Work mounted between centers to be ground at an angle is accurately positioned by setting the swivel table. Convenient hand lever can be used to give a 4" table reciprocation at any point in the path of travel.

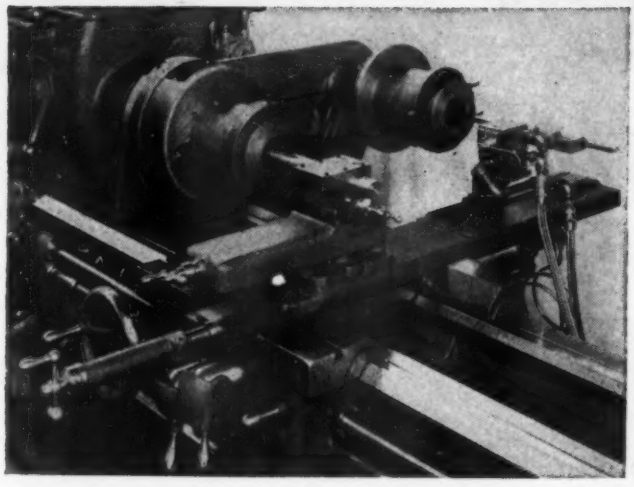


Accurate clearance angles are readily obtained by vertically swiveling the universal head.

Plain cutters may be sharpened by being mounted on a sliding shell on the cutter bar of the universal head.

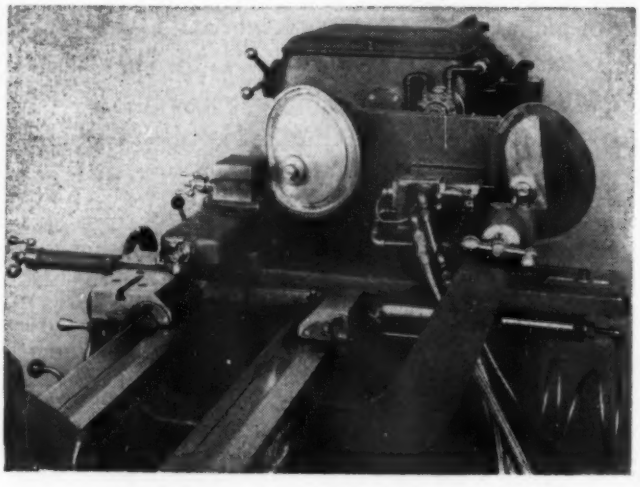
& SHARPE

SPRINGFIELD PROFILING AND DUPLICATING UNIT

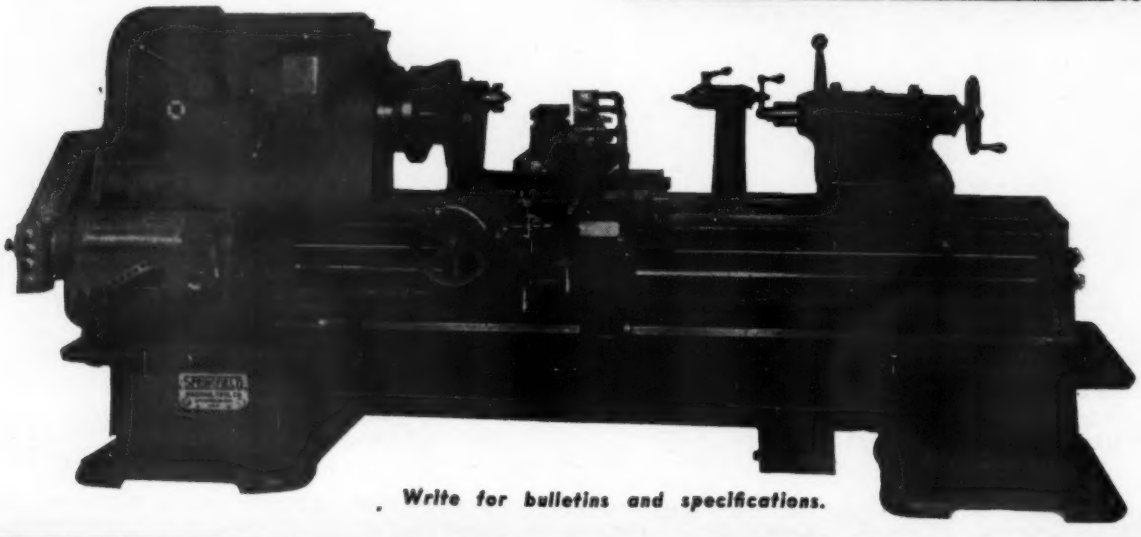


Duplicating a bottle mold is easy with the Springfield Profiling Machine. Any type of templet may be used. Templets requiring rotation are driven by an adjustable chain drive from the spindle. A master cylinder, located underneath the cross slide and controlled by a stylus valve, guides the tool in proper contour. Twelve spindle speeds are obtainable and speeds may be further reduced with a two-speed motor.

...reproduces complicated forms from cams to bottle molds, interior, exterior

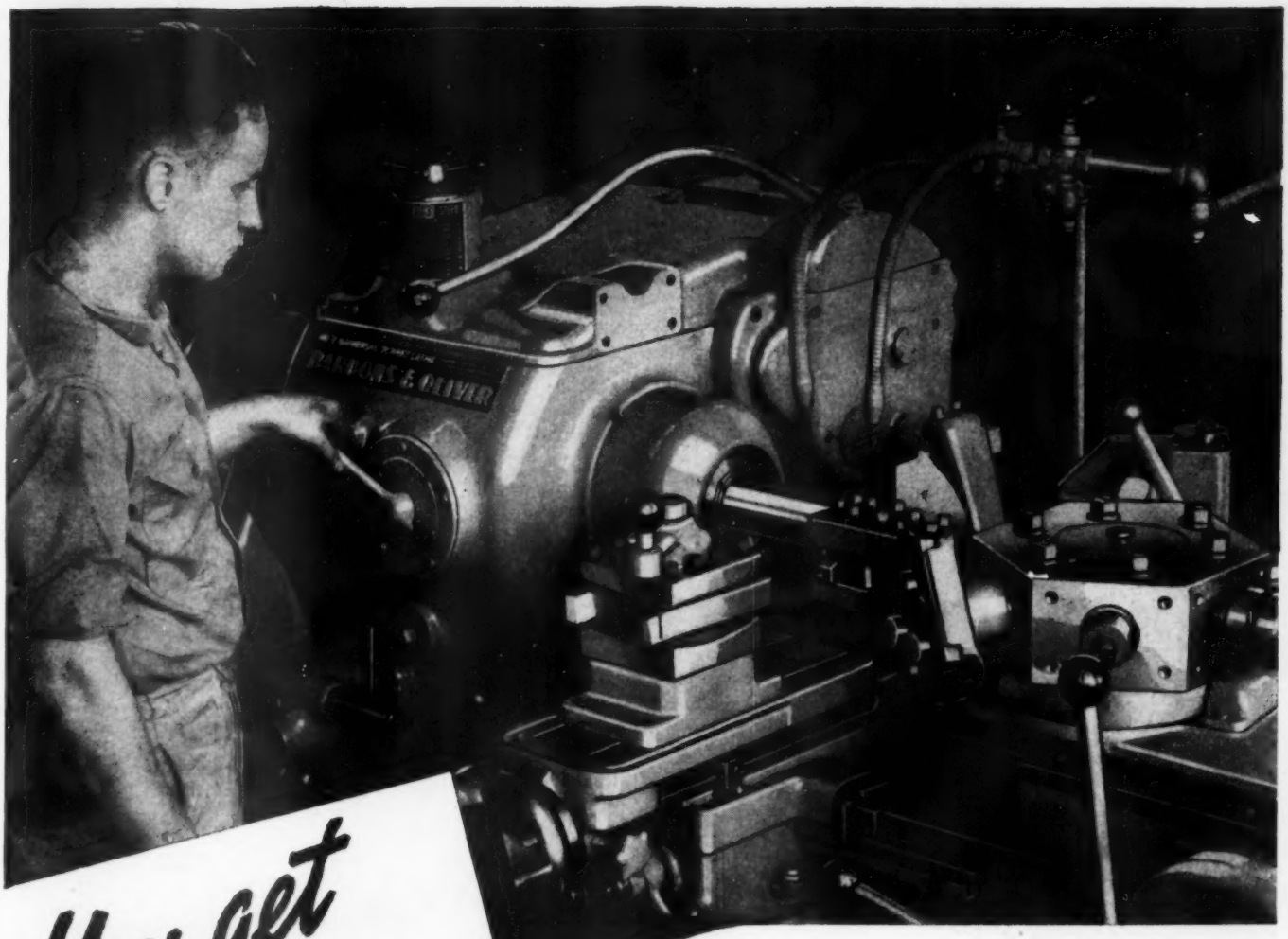


To produce a contour cam, as illustrated at the right, only a thin metal pattern is needed. Work requiring operations parallel with or across the machine can be handled with surprising accuracy. Operators have a clear view of the work at all times. A hydraulic pump unit that powers the profiling attachment may be located in any position adjacent to the machine. The adjustment of just two screws will convert the unit for regular engine lathe uses.



Write for bulletins and specifications.

SPRINGFIELD MACHINE TOOL COMPANY • SPRINGFIELD, OHIO



You get More Pieces Per Day—

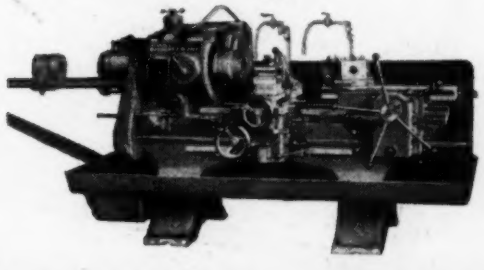
WITH THIS NEW POWER COLLET CHUCK AND BAR FEED

Feeding the bar and closing the chuck by hydraulic power increases production on a Bardons & Oliver No. 7 Universal Turret Lathe.

Quick, wrist-flick control saves time between cuts. Stronger grip of collet on the bar permits heavier feeds for decreased machining time.

Increased operator efficiency is the result of the eliminating of brute strength for chuck closing which causes fatigue and errors.

Investigate the possible savings in your plant from the use of this latest improvement of the Bardons & Oliver No. 7 Turret Lathe. Full details sent on request, or a representative will call.



BARDONS & OLIVER, INC.

1133 WEST 9TH STREET • CLEVELAND 13, OHIO

342 holes held to .0002" limit with JIGMIL automatic positioning

38 x 63 x 2¾" Thick
Steel boiler plate
Hole dia. limit .0001"
Overall Spacing Limit .0002"
The world's finest Jig Boring and Milling Machine

HOOVER TOOL & DIE COMPANY

DeVlieg Machine Company
450 Fair Avenue
Ferndale 20, Detroit,
Michigan

Gentlemen:

Enclosed is a photograph showing job done in our shop on the 38 J1g Mill.

PART: Motor Plate
SIZE: 38 x 63 x 2-3/4" thick
MATERIAL: Steel Boiler Plate
HOLE DIA. LIMIT: .0001"
OVERALL SPACING LIMIT: .0002"

As machine table travel is 48", it was necessary to reset work. This did not affect accuracy and the time made was highly satisfactory.

Very truly yours,
HOOVER TOOL & DIE COMPANY
C. W. Richter - Vice President & Chief Engineer

CWR:B
Enc. 1

Here are the results obtained by one user of 3-B DeVlieg JIGMILS on a difficult boring operation. The JIGMIL will also cut costs in your plant because:

(1) Only one set-up required for both boring and milling operations.

(2) Centralized Push Button Control Panel and Slide Lock Levers operated through finger-tip pressure.

(3) Automatic spacing to within .0001" of setting permits unvarying accuracy on jigs, fixtures and duplicate parts.

Technical literature available upon request. Write today.

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

"Temper Is Unaffected . . . Output Is Up 200%!"

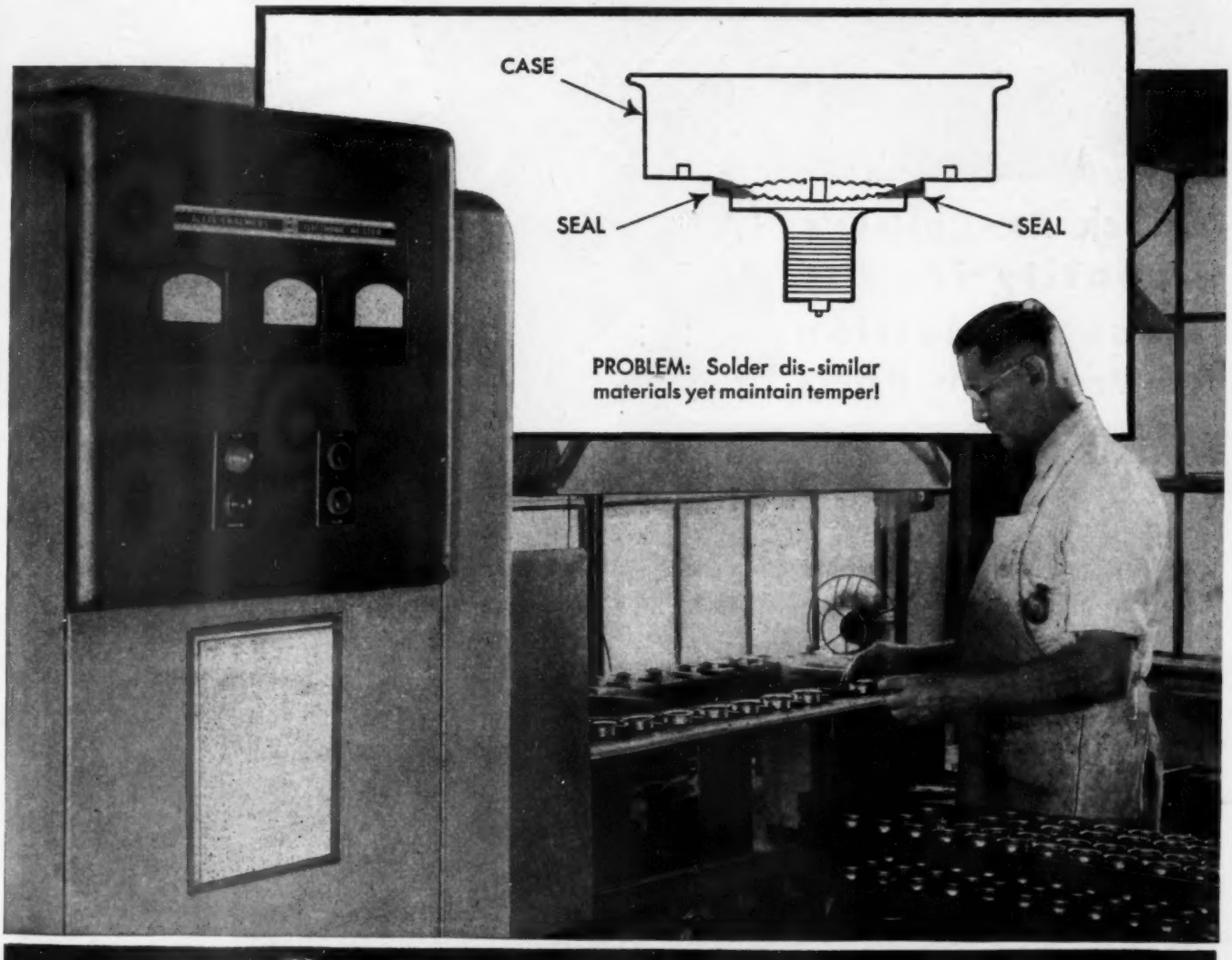
Says Mr. Warren Hastings, Plant Manager, ROCHESTER MFG. CO.

"MAINTAINING TEMPER of materials during soldering operations used to be a real test for *our* tempers! But now that we've installed our new Allis-Chalmers Induction Heater, we're able to apply just the *right amount* of heat to form an air-tight seal between our assembled parts. Not only does the temper of the materials remain *unaffected*, but now the operation is so simple that production *tripled*, and one man handles the entire job!"

These results are *typical* of how electronic induction heat solves problems of soldering, brazing and hardening metals . . . does better, faster work at lower cost!

If you have a *similar* job to do, or one which you *think* can be improved, why not let A-C's *experts* help you. Send samples to our modern process laboratories for careful analysis, estimates of per-piece production, and equipment costs. No obligation. Meanwhile, write for our *educational* bulletin 14B6430. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

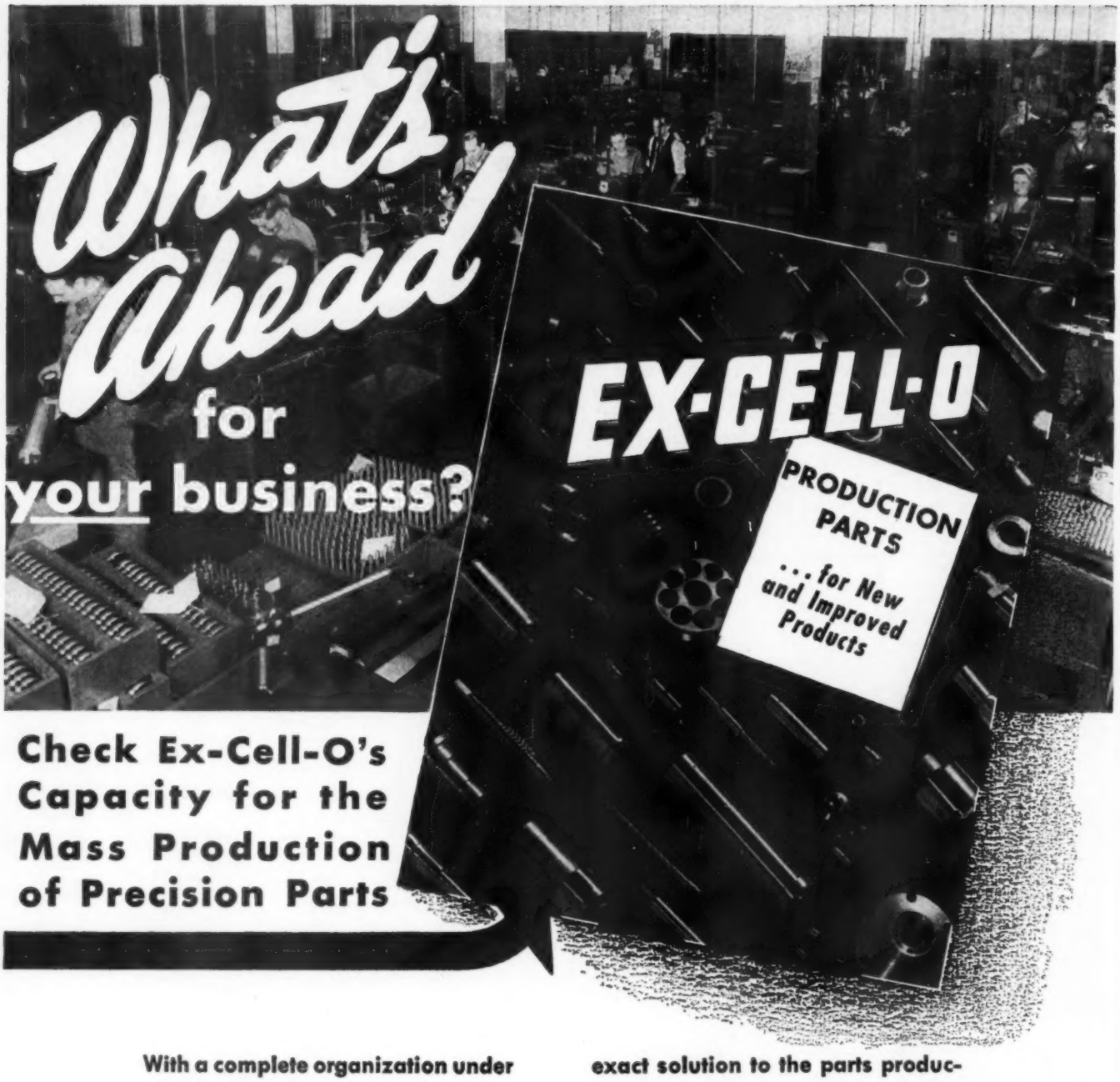
A 2112



ALLIS CHALMERS

One of the Big 3 in Electric Power Equipment
Biggest of All in Range of Industrial Products

INDUCTION HEATERS



Check Ex-Cell-O's Capacity for the Mass Production of Precision Parts

With a complete organization under one responsible management . . . *an organization built upon years of varied engineering experience, modern machining methods and heat treat facilities, and practical inspection staffs* . . . Ex-Cell-O probably has the exact solution to the parts production problem you face. The above folder illustrating Ex-Cell-O's complete parts production facilities will be sent you upon request. Write or wire Ex-Cell-O today and ask for Ex-Cell-O Bulletin No. 36151.

XLO
EX-CELL-O *for* PRECISION

Send sketch, blueprint or sample of your part to Ex-Cell-O

EX-CELL-O CORPORATION

DETROIT 6, MICHIGAN

HARDINGE *Collets for ALL Lathes and Millers*

Since 1890, Hardinge has symbolized accurate, durable, and low priced collets for all types and sizes of machines. Specify Hardinge collets and you will obtain maximum production efficiency in addition to these extra services:

ONE SOURCE OF SUPPLY

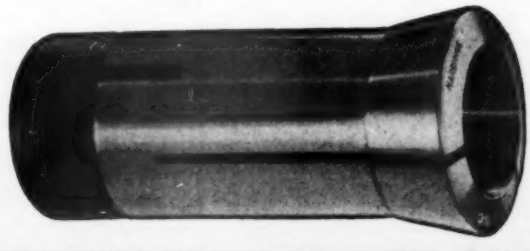
You can standardize on Hardinge Collets and have a complete selection for all makes of lathes.

PROMPT DELIVERY FROM STOCK

Collet stocks are constantly maintained in ten convenient locations throughout the United States: West Hartford; New York City; Elmira; Rochester; Cleveland; Detroit; Chicago; Minneapolis; Los Angeles; and San Francisco. No production hold-ups for Hardinge collets.

SIMPLIFIED ORDERING

Purchasing and Engineering Departments welcome the Hardinge Reference List which simplifies ordering because there is a Hardinge collet for every make of machine.



Take advantage of Hardinge complete collet facilities. Write today for Bulletin 41 which includes the special reference list and describes and prices Collets for all Lathes and Millers.

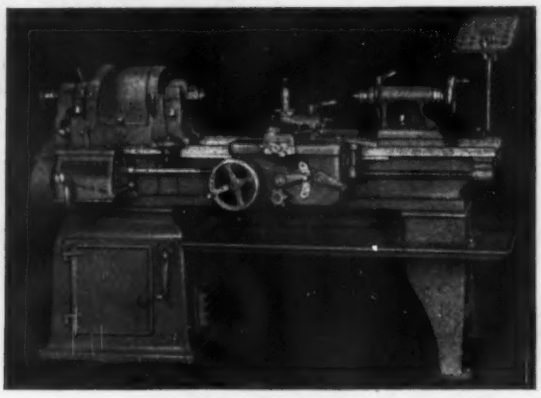
HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

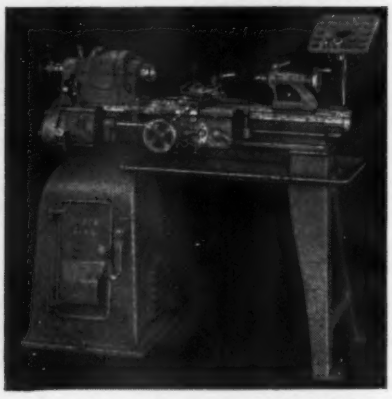
SOUTH BEND *Precision* LATHES

ENGINE LATHES • TOOLROOM LATHES • TURRET LATHES • ATTACHMENTS

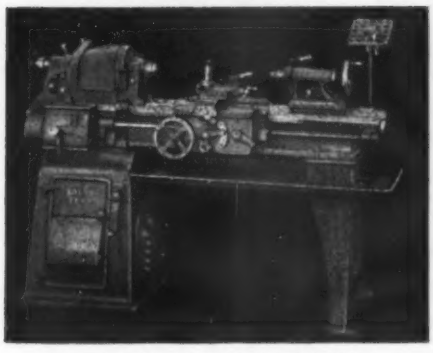
No. 1001-Z SOUTH BEND TURRET LATHE



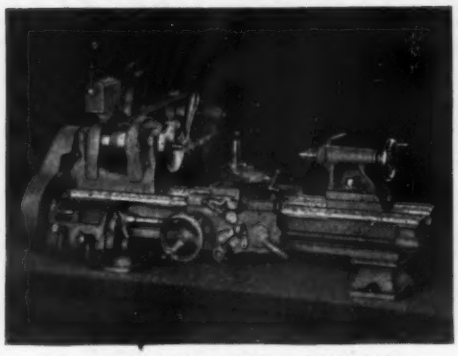
16" x 6' SOUTH BEND TOOLROOM LATHE



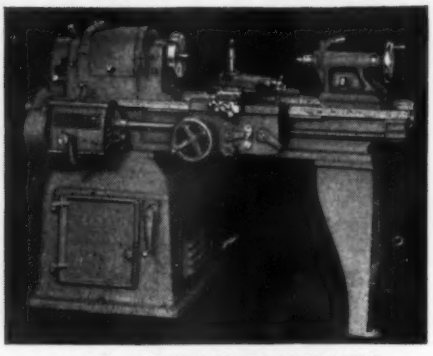
10" x 3½' SOUTH BEND TOOLROOM LATHE



13" x 5' SOUTH BEND TOOLROOM LATHE

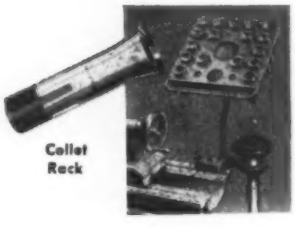


9" x 3' SOUTH BEND MODEL A BENCH LATHE



14½" x 5' SOUTH BEND ENGINE LATHE

A Size and Type for Every Need



Collet Rack

Thread Dial Indicator

Micrometer Carriage Stop

Accurate, versatile, fast, and easy to operate, South Bend Precision Lathes simplify the handling of difficult, close tolerance jobs in all types of laboratory, toolroom, production, and maintenance work. Practical South Bend attachments and accessories increase the scope of these lathes, and speed tooling and production.

South Bend Engine Lathes and Toolroom Lathes are made with 9", 10", 13", 14½", and 16" swings, and bed lengths to 12'. Turret Lathes are made with 9" and 10" swings, and maximum collet capacities to 1".

WRITE FOR CATALOG 100-D

Illustrates in full color, and gives complete, detailed specifications of all types, sizes, and models of South Bend Precision Lathes; shows all South Bend lathe attachments and accessories. Mailed free on request.

SOUTH BEND LATHE WORKS

419 E. MADISON STREET • *Lathe Builders Since 1906* • SOUTH BEND 22, INDIANA

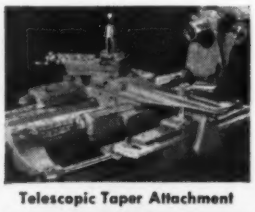
BROADEN THE SCOPE OF YOUR LATHES WITH THESE ATTACHMENTS

Electric Grinding Attachment

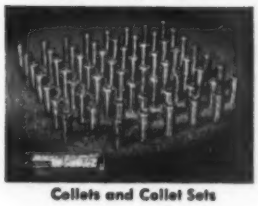
Draw-in Collet Attachment

Draw-in Collet Attachment

Center and Follower Rests

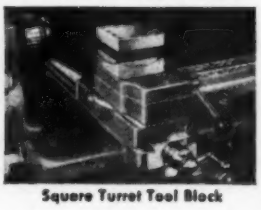


Telescopic Taper Attachment

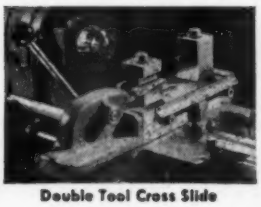


Collets and Collet Sets

Handlever Bed Turret



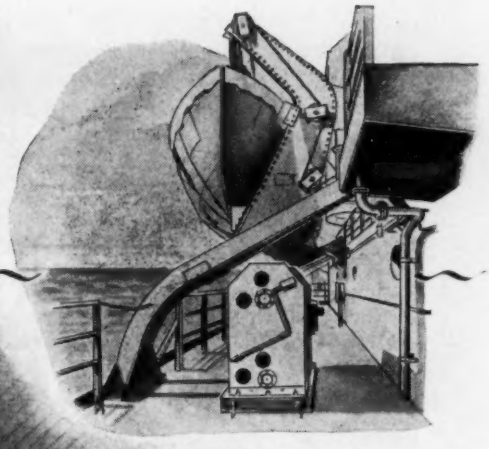
Square Turret Tool Block



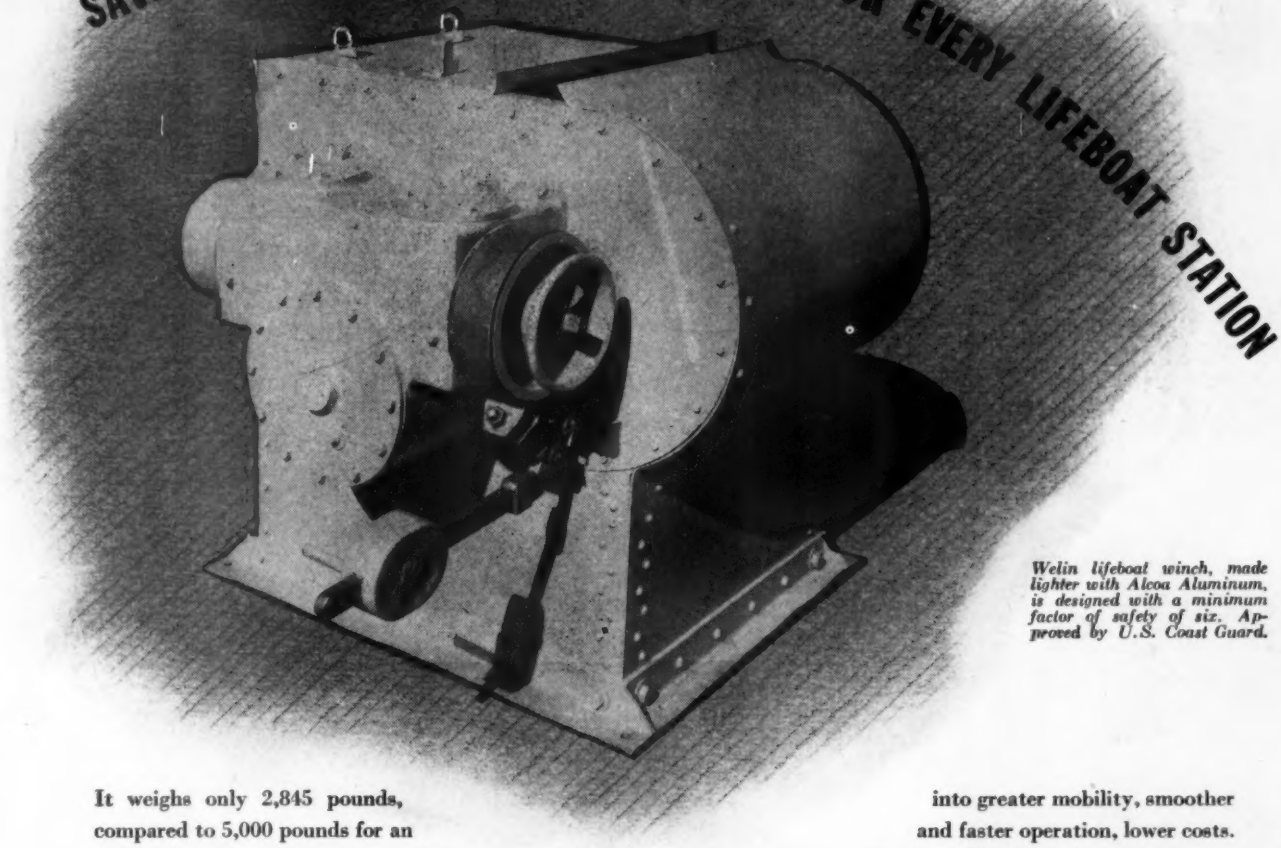
Double Tool Cross Slide

Double Tool Cross Slide

43% lighter!



SAVES OVER A TON OF DECK WEIGHT FOR EVERY LIFEBOAT STATION



Welin lifeboat winch, made lighter with Alcoa Aluminum, is designed with a minimum factor of safety of six. Approved by U.S. Coast Guard.

It weighs only 2,845 pounds, compared to 5,000 pounds for an old-style winch—this newest addition to Welin Davit & Boat's line of "all-aluminum" lifesaving equipment. That's a ton of deck weight eliminated for every lifeboat station. Compensating ballast can be less, payloads higher.

IN YOUR PRODUCTS. As in that marine equipment, Alcoa Aluminum will give your products added utility value. Perhaps the weight you save translates itself into greater mobility, smoother and faster operation, lower costs.

Aluminum's ability to resist corrosive attack, and its resulting longer life, often opens new markets for your products. The many attractive, durable surface finishes possible with Alcoa Aluminum give added sales appeal.

To find out what aluminum will do for you, get in touch with the nearby Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Bldg., Pittsburgh 19, Pa.

ALCOA FIRST IN **ALUMINUM**

IN EVERY COMMERCIAL FORM

Meets Job Requirements with

SIMPLE CONTROLS FOSDICK RADIALS

● On jobs like this, where there are innumerable holes to be drilled, a Fosdick Hydraulic Radial is ideal.

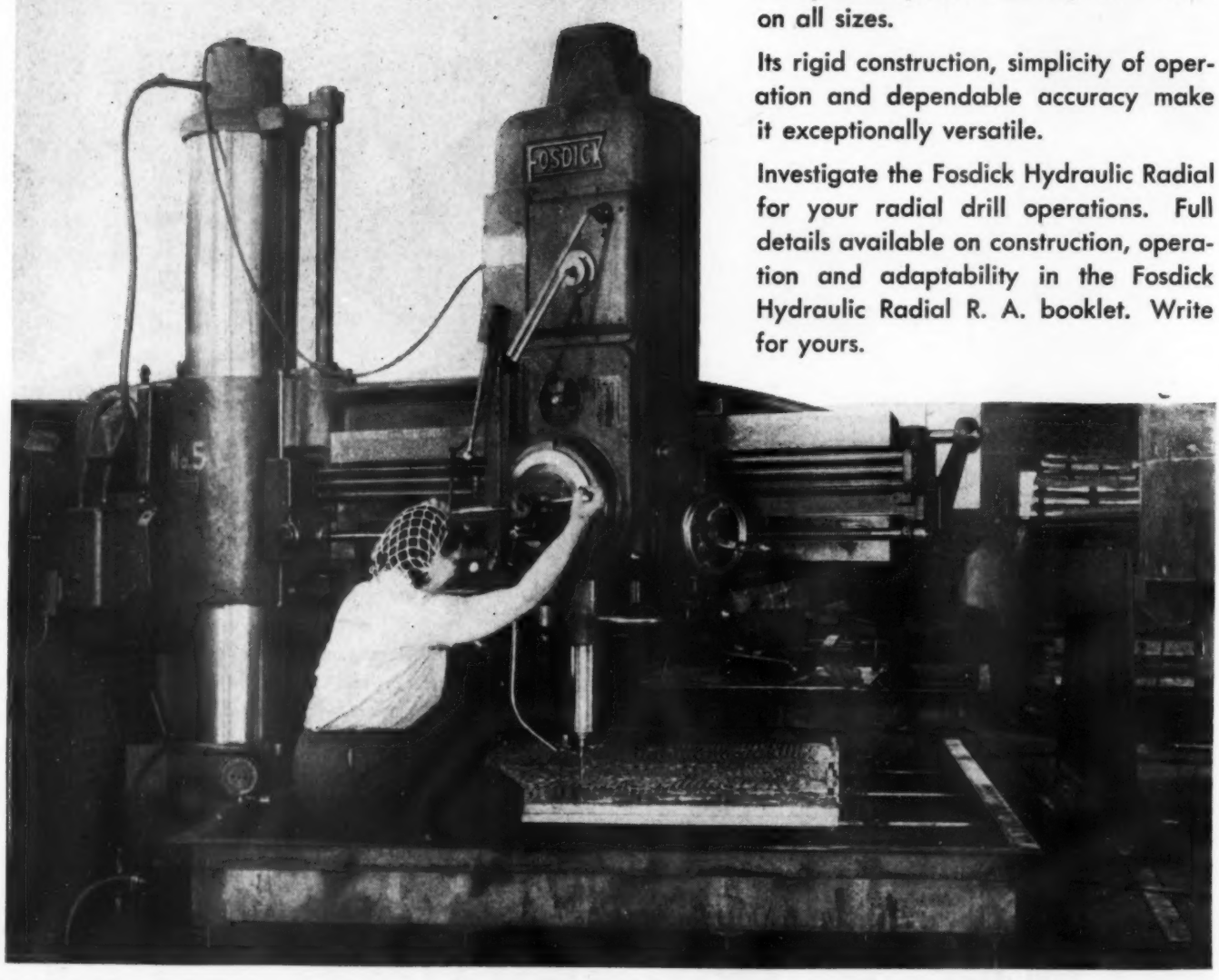
Complete hydraulic control with all controls centralized in the head, the operator can drill more holes faster with a Fosdick Hydraulic Radial.

Rapid traverse to head, column clamp and interlocking lever for unclamping, raising and lowering arm are all hydraulically controlled. This insures positive operation and provides exceptional ease of operation.

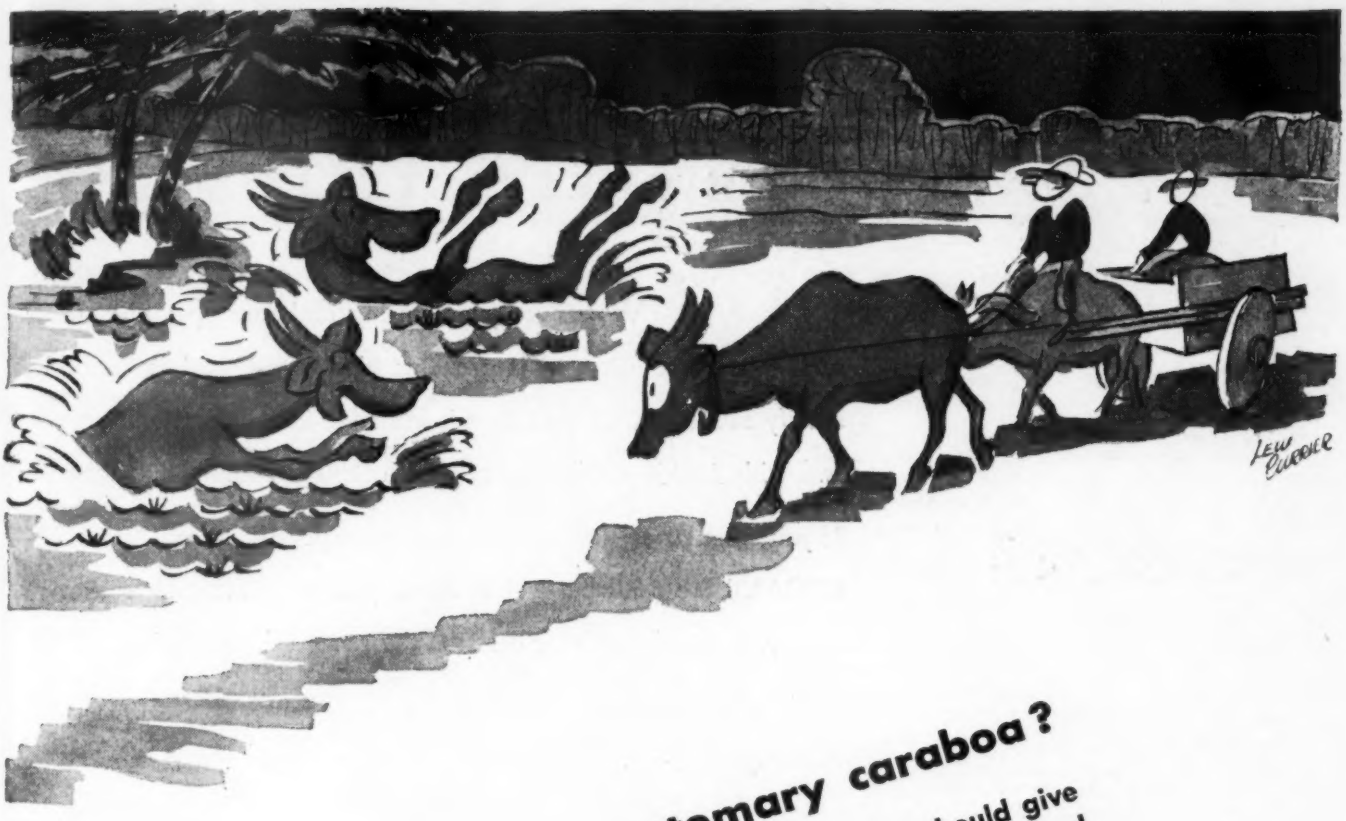
The machine offers a selection of thirty-six spindle speeds and eighteen feeds on all sizes.

Its rigid construction, simplicity of operation and dependable accuracy make it exceptionally versatile.

Investigate the Fosdick Hydraulic Radial for your radial drill operations. Full details available on construction, operation and adaptability in the Fosdick Hydraulic Radial R. A. booklet. Write for yours.



FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO



Have you a costly customary caraboa?

The billion people in Asia comprise a labor force that should give China and India the world's highest standard of living. But instead of machines, these Asiatics still ride and drive the customary caraboa.

Because his pace is slow, and he stops every two hours to take a mud bath, his day produces little, his driver earns only a few handfuls of rice, and his owner flirts with starvation. Tragic!

In America oxen went out before you were born. But the best tools are still not being used in all the places where they might be. In many of the best production lines a few slow, high-cost, caraboa operations remain. Why not bring in your cost sheet and discuss special tools for operations that are eating up too many man hours?

ENGINEERING • PROCESSING • DESIGNING • BUILDING
SPECIAL TOOL AND MACHINERY MANUFACTURING

HAVE YOU TRIED MO-MAX COBALT?

HIGH SPEED STEELS

Whenever your cutting tools are operating under such severe conditions that a cobalt high speed steel is desirable, specify MO-MAX COBALT. It is available in four distinctive types, two with 5.00% cobalt and two with 8.00% cobalt.

If your regular sources cannot make prompt delivery on MO-MAX COBALT, we shall be glad to direct you to an available source of supply. In writing, please describe the proposed application.

Full information will be found in the MO-MAX Handbook. See Pages 27-28.

Buyer's Guide to Brands of MO-MAX

"LMW"	Allegheny Ludlum Steel Corp.
"MOHICAN"	Atlas Steels Limited
"BETHLEHEM HM"	Bethlehem Steel Co.
"MO-CUT"	Braeburn Alloy Steel Corp.
"STAR MAX"	Carpenter Steel Company
"MOLITE M-I"	Columbia Tool Steel Co.
"REX T-MO"	Crucible Steel Co. of America
"DI-MOL"	Henry Disston & Sons, Inc.
"HI-MO"	Firth-Sterling Steel Company
"REX T-MO"	Halcomb Steel Company
"MOGUL"	Jessop Steel Company
"TATMO"	Latrobe Electric Steel Co.
"MIDMAX"	The Midvale Co.
	St. Lawrence Alloys, Inc.
"S. T. M."	Simonds Saw & Steel Co.
"MO-TUNG"	Universal-Cyclops Steel Corp.
"8-N-2"	Vanadium-Alloys Steel Co.
"VUL-MO"	Vulcan Crucible Steel Co.

ONLY MO-MAX GIVES YOU *all* THESE ADVANTAGES

1. MO-MAX has superior cutting qualities. It is a happy combination of great toughness with high hardness.
2. The machinability of MO-MAX is unexcelled, particularly in grinding.
3. MO-MAX is economical. Its specific gravity is about 8% less than that of 18% tungsten steel. Thus for the same weight of high speed steel, 13 bars of MO-MAX are obtained as compared with 12 similar bars of an 18% tungsten steel.
4. In addition to the standard general-purpose composition of MO-MAX high speed steel, several special types have been developed for particular purposes. There are four with a high cobalt content, one high in vanadium and two that are especially suitable for hot die work.
5. MO-MAX was the first of the modern molybdenum high speed steels. For 13 years MO-MAX has demonstrated its superiority in cutting tools.

★ ★ ★

Send for your copy of the MO-MAX Handbook, sixth edition. Get the full story about this remarkable steel, including easy-to-follow instructions on heat treating.

THE CLEVELAND TWIST DRILL COMPANY • 1242 East 49th Street • Cleveland 14, Ohio

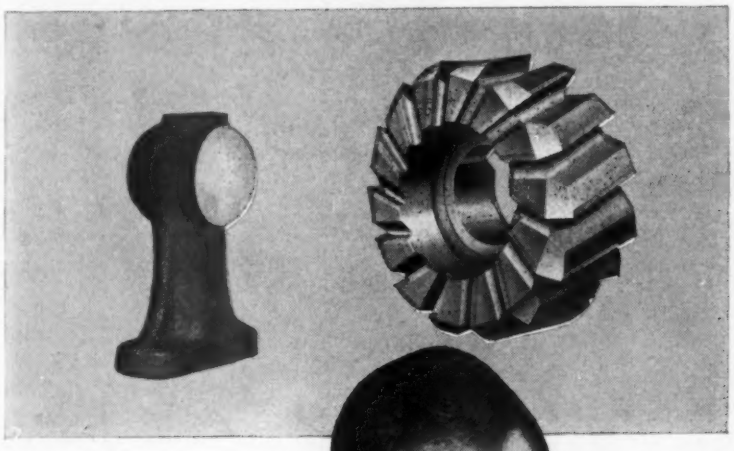
BARBER-COLMAN

HOBS • HOBBING MACHINES • HOB SHARPENING MACHINES • MILLING CUTTERS
REAMERS • REAMER SHARPENING MACHINES • SPECIAL TOOLS

STANDARD SHELL END MILLS

DELIVERED FROM STOCK

FACE 960 CAST IRON BRACKETS PER DAY



The exceptionally good performance of these Barber-Colman Standard Paraform Shell End Mills is permitting this manufacturer to obtain *peak production efficiency* from his machine investment. In addition to high speed operation . . . 436 surface feet per minute . . . cutting time of 15 seconds . . . these cutters are producing *1500 brackets per sharpening,* milling ⅛" by 1½" stock from both sides. This unusual tool performance is not difficult to understand in the light of these carefully engineered features of all B-C Milling Cutters: *proper tool steel,* controlled by chemical and physical analysis, *Paraform tooth design,* combining maximum tooth strength with greatest chip clearance, *controlled heat treatment,* with structure and hardness carefully checked, *accurate manufacture,* precision sharpening and close tolerances maintained. When you buy Barber-Colman Standard Milling Cutters . . . from stock . . . you are getting high production performance, long tool life and low tool cost per unit of manufacture.

JOB FACTS

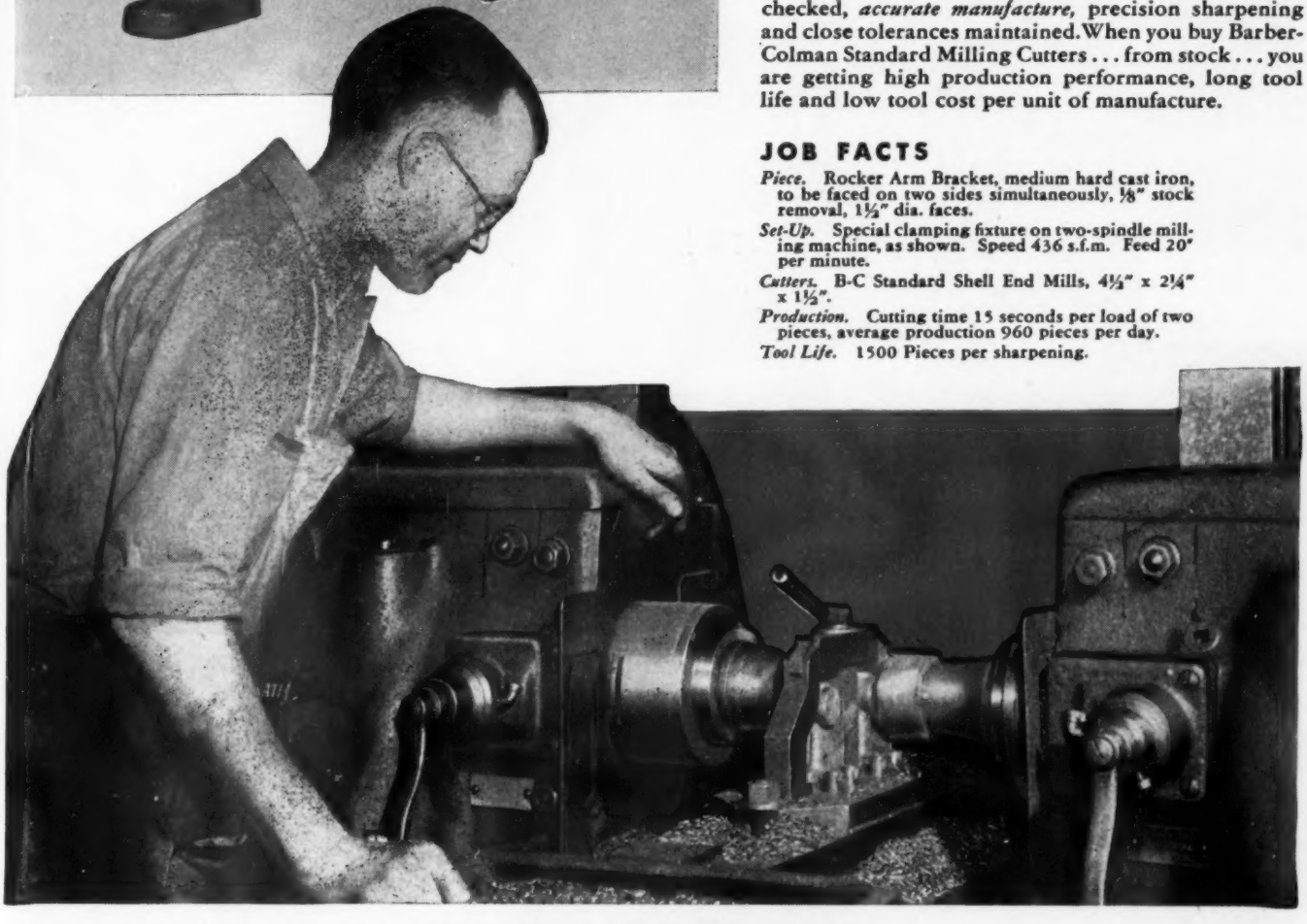
Piece. Rocker Arm Bracket, medium hard cast iron, to be faced on two sides simultaneously, ⅛" stock removal, 1½" dia. faces.

Set-Up. Special clamping fixture on two-spindle milling machine, as shown. Speed 436 s.f.m. Feed 20" per minute.

Cutters. B-C Standard Shell End Mills, 4½" x 2¼" x 1½".

Production. Cutting time 15 seconds per load of two pieces, average production 960 pieces per day.

Tool Life. 1500 Pieces per sharpening.



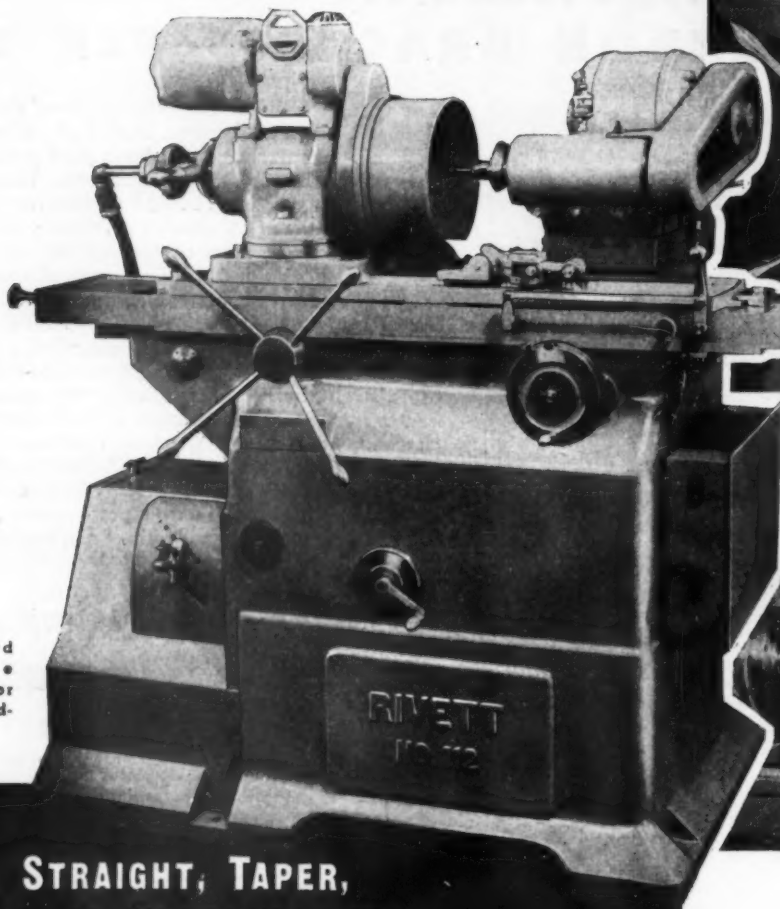
BARBER-COLMAN COMPANY

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

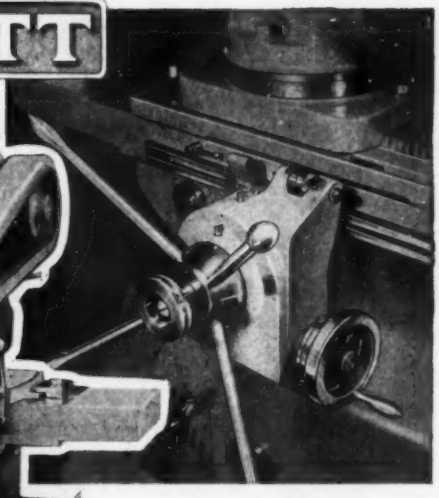
GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

A MORE *Versatile* PRECISION GRINDER

RIVETT



Standard machine equipped for internal grinding.



Fine table feed with micrometer stop for shoulder and face grinding.

Bracket with spindle for external grinding and tail stock for mounting work on centers.

FOR STRAIGHT, TAPER, BEVEL OR STRAIGHT AND BEVEL GRINDING

The Rivett No. 112 Universal Grinder is primarily for tool room work. Internal and external spindles, in combination with many adjustments, make possible a greater variety of precision operations. Extreme simplicity of design assures easy and efficient operation by even the lay machinist.

SPECIFICATIONS

Grinding cap., hole dia.	1/8" to 8"
Grinding cap., outside dia.	up to 8"
Automatic table travel	1/2" to 8"
Table speeds	18 selective
Hand table travel	16"
Swing over table	14"
Workhead swivel	90°
Table swivel	5°
Cross slide swivel	90°
Cross feed graduations	.0005"
Travel of cross slide	3 1/2"
Collet capacity	1"
Step chuck capacity	8"
Jaw chuck capacity	8"
Workhead speeds	
Spindle	150-450 r.p.m.
Dead center	100-300 r.p.m.
Grinding spindle speeds:	
Internal	5000 to 25000 r.p.m.
External	3300 r.p.m.
Automatic Oil Lubrication	
Net weight with motors	3700 lbs.

RIVETT LATHE & GRINDER INC.

ARMY E NAVY

BRIGHTON, BOSTON, MASS.

SEND FOR OUR NEW 4-PAGE GEAR CATALOG

Small Gears are made in almost endless variety. Frequently their applications are entirely without precedent. This was especially true during the war. New principles, new design, new engineering, a different approach to power transmission problems . . all these things and more are often required to produce the greater efficiency and economy of G.S. Fractional Horsepower Gears. The G. S. Gear Catalog just printed, illustrates and describes many different types and applications of G. S. Small Gears. It offers valuable aid to *anyone* concerned with specifying Gears from 12 to 96 D.P. Just ask for a copy on your company stationery. No cost or obligation is involved.

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WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

War-time Shortage Produced a BETTER RUBBER for TEXROPE V-BELTS

LACK of natural rubber forced the development of synthetic rubbers. And out of this intensive war-time research came a rubber compound that has made today's TEXROPE "Super-7" V-Belts the BEST in 20 years of V-Belt experience!

This war-proved Buna-S develops 75% less internal heat. It's tough, durable, resilient. It cushions, insulates and protects the load-carrying cord structure — adds to the service life of the belt.

HEADQUARTERS FOR V-BELT DRIVES

Your nearest Allis-Chalmers office or dealer offers a COMPLETE line of V-Belt equipment — not only the famous Super-7 belts, but also TEXSTEEL, TEXDRIVE and "MAGIC-GRIP" sheaves, VARI-PITCH sheaves, SPEED CHANGERS, engineering service. Supply *all* your needs from one reliable source. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

A 2086

5 Super-7 V-Belts ... TO MEET EVERY NEED

Heat-Resisting Super-7
Stands temperatures up to 180°. The TEXROPE V-Belt for most drives.

Oil-Resisting Super-7
Neoprene cover protects core against moderately oily or greasy conditions.

Oil-Proof Super-7
Made of Neoprene throughout. Use it when the belt must swim in oil.

Static-Resisting Super-7
Recommended where explosion hazard exists. Static-conducting element throughout cover won't wear off.

Super-7 Steel
Twin steel cables, to pull extremely heavy loads with minimum stretch.

GET THEM — through your Allis-Chalmers district office or dealer.

TEXROPE Super-7 V-Belts result from the co-operative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

ALLIS-CHALMERS

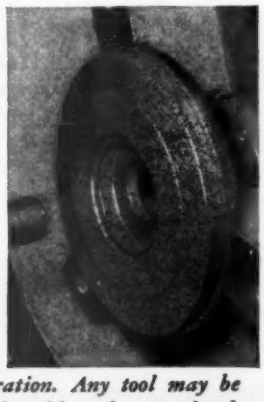
One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

TEXROPE V-BELT DRIVES

A Standard Machine "built-to-order" for Machining Flywheels

THE GISHOLT SIMPLIMATIC

Plunge type tooling for first operation in machining cast iron flywheels.



Tooling for second operation. Any tool may be quickly removed and replaced by a sharpened tool.

It may sound incongruous, but it isn't.

This standard Gisholt Simplimatic of the vertical head type provides the ideal tooling set-up to duplicate the ability of a machine designed for a specific job—in this case of machining flywheels. In only two operations of 1.3 minutes each, both faces of flywheels are rough machined on all surfaces.

The simple basic design of this modern automatic lathe makes it possible to individualize the machine to answer a wide variety of machining jobs with high production and low cost. Available in both vertical head and platen types, the Gisholt Simplimatic is a wise selection where you have parts to produce in large volume. Ask for all the facts about it.

GISHOLT MACHINE COMPANY

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Keep Ahead
with Gisholt

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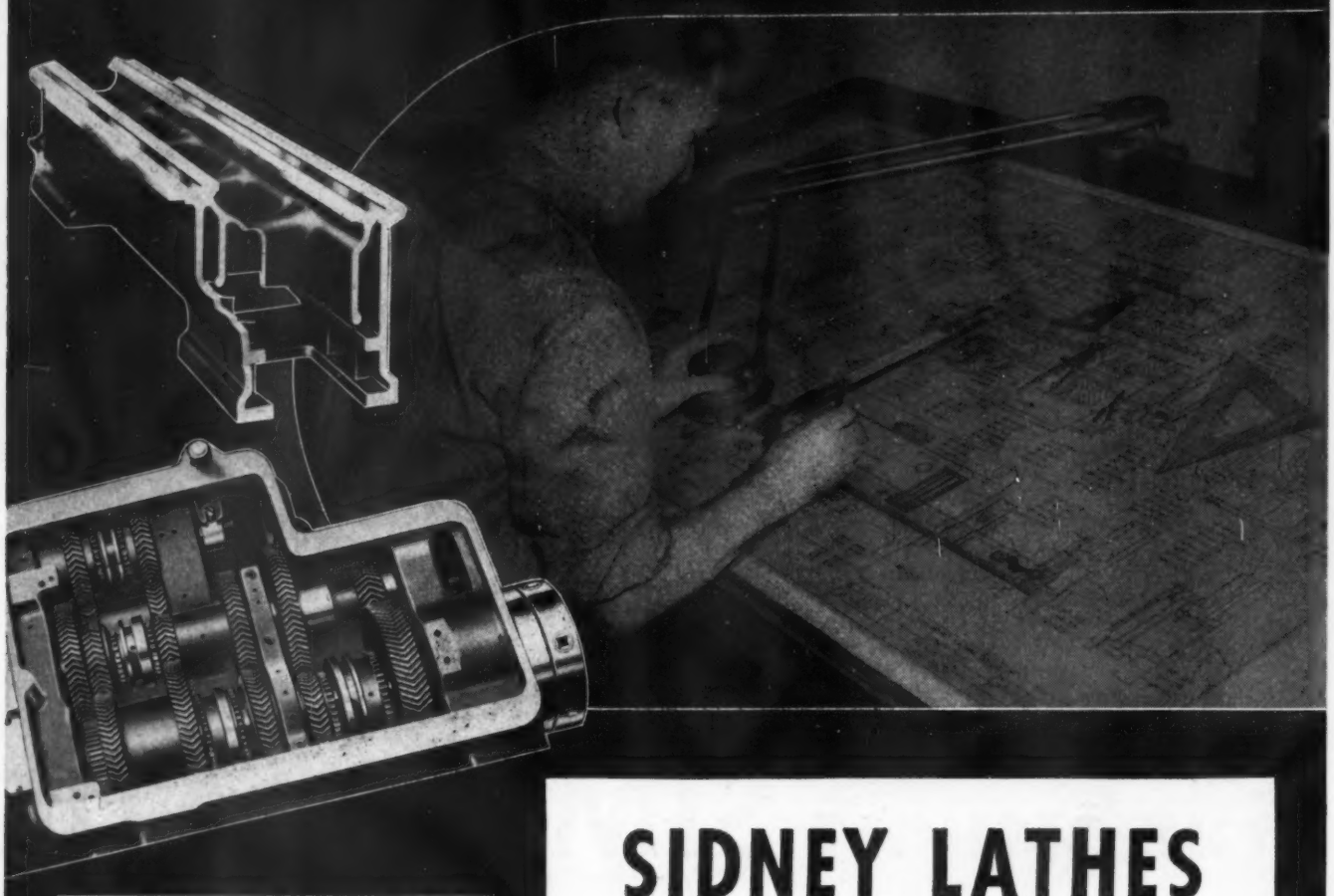
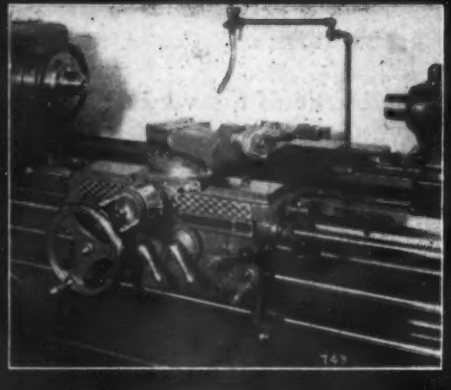
DESIGNING *today for the needs of tomorrow*





SIDNEY LATHES

● The ever increasing demand for higher speeds—increased feeds—greater production requires design changes to not only meet today's needs but anticipate future requirements.

Sidney is building for the future. These lathes are being designed and built to handle carbide tools to the limit of their productive capacity.

For example the Continuous Tooth Herringbone Geared Head provides greater power and smoother power to the spindle. Eliminates vibration and chatter marks on the work. Anti-friction center bearings on intermediate shaft and spindle assure maximum strength.

The Compound Rest has large circular swivel block permitting swivelling of compound to any angle. Top slide has no overhang even when fully extended.

Swivel graduated in degrees on both sides. Large micrometer graduated dials on cross feed and compound rest screws provide easy, quick adjustment by operator.

The bed of semi-steel has four longitudinal walls with the gross girts at 12 inch intervals. This modern construction assures accuracy under heaviest cuts and resists deflections and twisting strains.

As you look to the future, look to Sidney for accuracy —high production—and flexibility of operation.

Full descriptive bulletins on all sizes available.

Builders of Precision Machinery

THE SIDNEY MACHINE TOOL COMPANY

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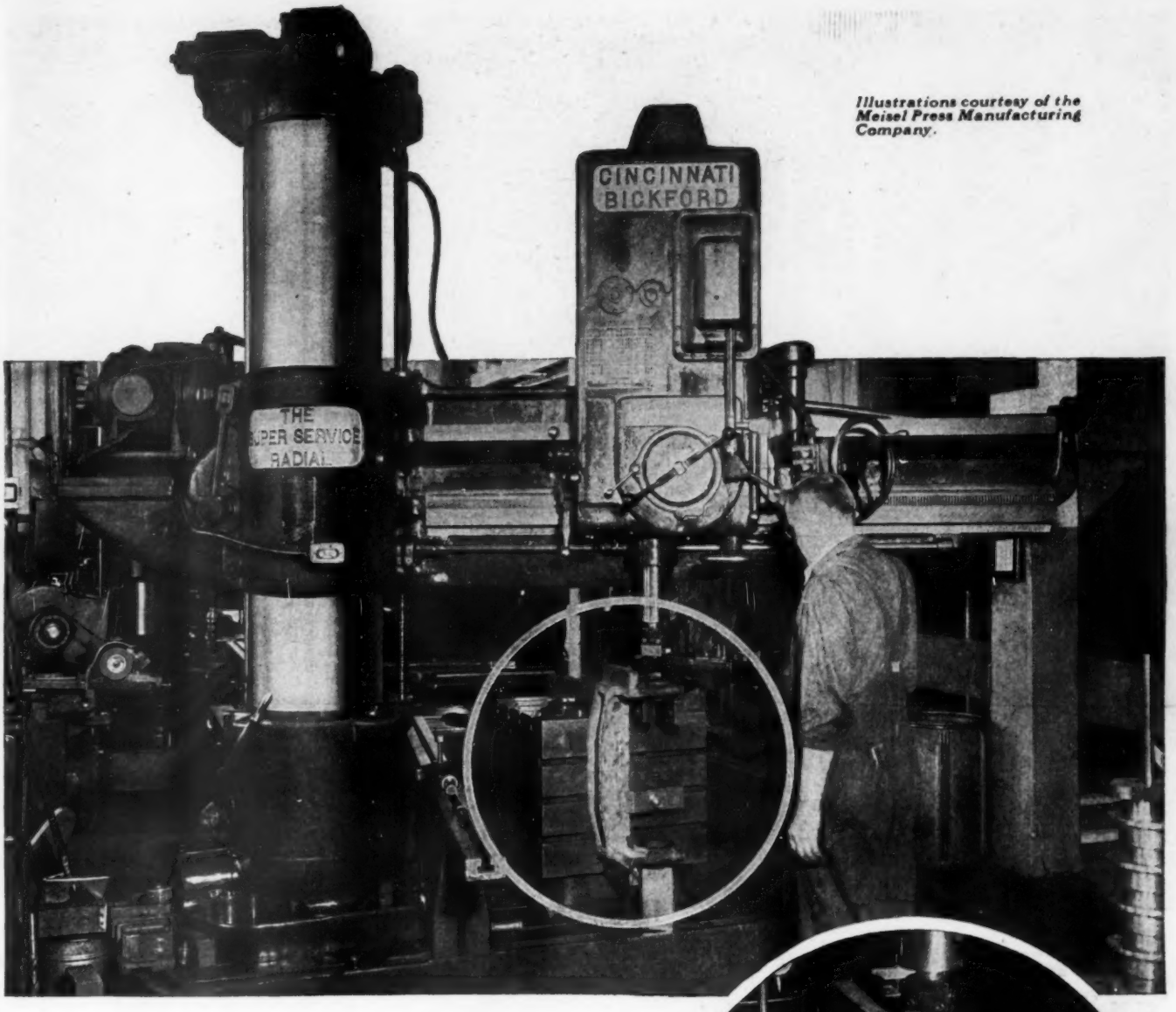
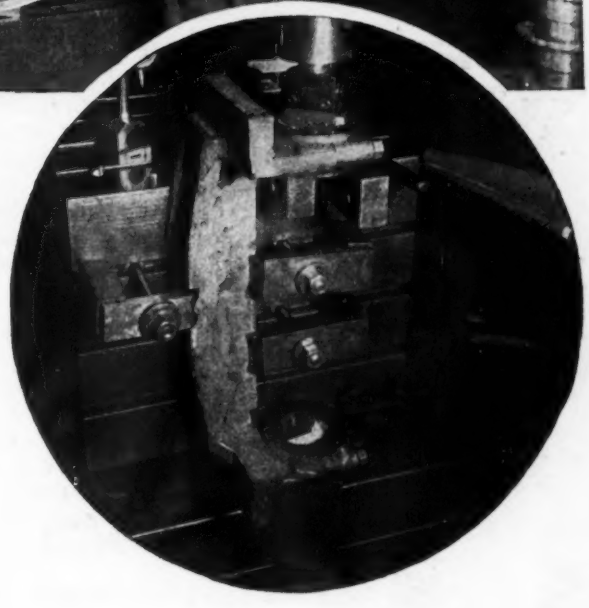
SIDNEY

ESTABLISHED 1904



Illustrations courtesy of the Meisel Press Manufacturing Company.

LIMITS WERE CLOSE!



Boring and reaming the main bearings of a cutting cylinder to .0005 limits with a Cincinnati Bickford Super Service Radial Drill has effected a 20% saving over previous machines at the Meisel Press Manufacturing Company, Boston, Massachusetts.

The accuracy of Cincinnati Bickford Super Service Radial Drills, and their ease of handling, made this worthwhile saving possible in small lot production.

Write for detailed Bulletin R-24A.

See our condensed Catalog in Sweet's File.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

THE 6 DANLY PRODUCTS IN THIS PICTURE

FIT INTO MANY PLACES IN YOUR PICTURE

DANLY PRECISION DOWEL PINS have a big job to do in the Steel, Non-ferrous metals and Plastic Industries. Accurate through their length, there will be no expensive re-drilling and reaming, because Danly Precision Dowel Pins are diamond tested for hardness and ground to a tolerance of one-ten thousandth of an inch . . .

DANLY DIE SPRINGS are noted for *staying power*. The repeated pressure of the ram many times every hour induces fatigue that will snap ordinary die springs—and that means tearing down the whole setup. Two complete lines. *MEDIUM PRESSURE—HIGH DEFLECTION; HIGH PRESSURE—MEDIUM DEFLECTION.*

DANLY SOCKET-HEAD STRIPPER BOLTS incorporate the same advantages as the Danly Knurled Socket-Head Cap Screws. Busy fingers don't slip on the knurled head . . .

DANLY KNURLED SOCKET-HEAD CAP SCREWS save time and money. Here's why: Oily fingers readily grasp the knurled head—the mechanic can drive it a good part of the way by hand before using the wrench. Infinite applications—a wide range of sizes . . .

DANLY KWIK-KLAMP TOGGLE CLAMPS are versatile, all-around utility clamping tools. Strong construction combined with simplicity of operation makes Kwik-Klamps a must wherever quick, positive clamping action and known pressures are desired . . .

THE DANLY DIE SET needs no introduction. A *must* for precision stamping, Danly die sets are once more paving the way to that new washing machine and electric iron in every home—that new car in every garage . . .

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Danly Tool, Die and Gage Makers' Supplies

American Machinist's Spot NEWS OF METALWORKING

General Electric's purchase of Mahoning Valley Steel and Borg-Warner's acquisition of Superior Sheet Steel may be forerunners of attempts by other steel users to insure themselves a supply of steel during the period of shortages ahead.

Chevrolet's small car project is about to be revived. Mechanical press orders for it have been reinstated and rumblings are heard among other equipment sources that the "go-ahead" may be given again. Even so car production would not begin until sometime in 1948.

British machine tool industry is having much the same troubles as our own. It has been able to call back from the services fewer men than expected and may have to stage a labor recruiting drive. Shortages are reported in iron catsings and ball bearings.

Long-range prediction about forging shops—one top executive in forging industry says that in five years a large percentage of the industry will be converted to induction heating, thus cutting down floor space, reducing production time and giving relatively scale-free forgings. At long last the forging operator will have as clean an occupation as a present-day machinist.

Renault, French automobile maker, is retooling for large production, counting on putting out a small car which will sell in world markets formerly supplied by Fiat.

> **Missiles reported seen over Sweden are not meteorites, but Russian buzz bombs. They come from old German research center of Peenemunde, seized intact by the Russians. They are cigar-shaped, jet-type missiles smaller than the V-2, without wings or tails. Some are believed to be remote controlled and have been seen changing their course and heading eastward.**

Absenteeism is biggest problem aside from shortages in keeping up production. Fridays and Mondays are the worst days, more than doubling the absenteeism of 8% during the rest of the week in many shops. Week-ends in some Pacific Coast plants end with 20-25% of employees absent on Mondays.

Curved windshields and more glass are headaches for car body designers who are thinking in terms of 1948 models. More glass will add to car weight, as average steel body panel weighs only half as much as the glass which will replace it. Curved windshields mean double the cost for flat glass, and optical problems besides. Much-glassed bodies will be hot unless suitable shades, perhaps venetian blinds, can be provided for them.

Electro-Motive Corp. has $100,000,000 backlog for new F3 diesel-electric locomotive. About 30 railroads have ordered 746 of the new units. Electro-Motive will build 65-70 units a month, plus 20 switchers. In 1947 company anticipates production of 900 F3 units along with 300 switchers. Electro-Motive soon will have in full swing former Pullman-Standard plant on subassemblies.

Many new machine tool dealers have withdrawn from selling surplus machines because of WAA's slash-price policy. Used machine dealers are not happy because many of them loaded up with machines bought at the Clayton formula prices only to have their inventories take a sharp drop when WAA knocked the props out from under prices.

Heat pump, or reverse-cycle refrigeration heating and cooling unit, is being eyed as a possible large-volume product by Middle West companies. Terra-Temp Co., Indianapolis, and Muncie Gear Works have entered the field. A prominent electric manufacturer also is interested.

Kaiser-Frazer is asking permission to set up Australian manufacturing plant at Melbourne, with subsidiary plants in other cities. Company would be known as Liberty Motors, Ltd., to commemorate prowess of Kaiser's name in shipbuilding. Plans are to use Australian sub-contractors and imported parts and have first models on the market next May.

THIS HYDRAULIC OIL { Prevents Sludge / Prevents Rust / Prevents Stoppages

TEXACO *Regal Oils (R & O)* for hydraulic systems, in the viscosities recommended for your particular equipment, will prevent costly stoppages caused by sludge and rust.

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FOR ALL HYDRAULIC UNITS

Tune in . . . TEXACO STAR THEATRE presents the NEW EDDIE BRACKEN SHOW every Sunday night. Metropolitan Opera broadcasts every Saturday afternoon.

American Machinist

ESTABLISHED 1877

BURNHAM FINNEY, Editor

An Ill-Advised Surplus Policy

War Assets Administration's slash in prices of hard-to-sell surplus machine tools has started out badly.

To begin with, high WAA officials broke faith with their own Metalworking Machinery Industry Advisory Committee. They promised to consult it before making a decision, but didn't. When the committee finally was called together, the new policy was an accomplished fact. Even so, the members were unanimously opposed.

Then WAA terms the new program a "fixed-price" policy. It is not that. It is a cut-price plan pure and simple. One would think that there had been no fixed-price policy all along. What is the Clayton formula, providing for a sliding price scale based on age?

Arguments on behalf of WAA's new program are: (1) the main job is to get surplus machines into use, sale price being relatively unimportant; (2) a lower price level will bring marginal customers into the market who later may buy new tools; (3) the government should sell out fast at a time of high business activity when surplus machines can be absorbed without disrupting the machine tool industry; and (4) because holding capital equipment may tempt government to go into production for use.

These arguments do not appear too impressive when set down alongside the ill effects arising from the new cut-price policy.

The machine tool industry has feared from the beginning that after the war large quantities of surplus machines would be dumped on the market at distress prices. Great harm was done following World War I when exactly that occurred. The Clayton formula was devised to prevent its recurrence. It has worked well. The government thereby has recovered about 48% of the original cost of machines, a much larger percentage than has been obtained from any other kind of surplus war material.

Clayton prices have caused little if any complaint. Slowness in sales has developed more from difficulties in getting deliveries and from other troubles arising from dealing with WAA's inexperienced, constantly changing and sometimes incompetent staff than from price barriers.

We believe that WAA is proceeding on the erroneous theory that machine tools can be sold as you would sell eggs or radios. A buyer either needs a machine or he doesn't. Cut prices are virtually no inducement.

We further think that the cutting of prices on some machine tools will make it increasingly hard if not impossible to sell any machines from now on at the Clayton schedule. Why should customers pay Clayton prices today when tomorrow they may be able to get the same machines at a much lower figure? WAA says that this won't happen, but what guarantee is there that WAA will keep its word?

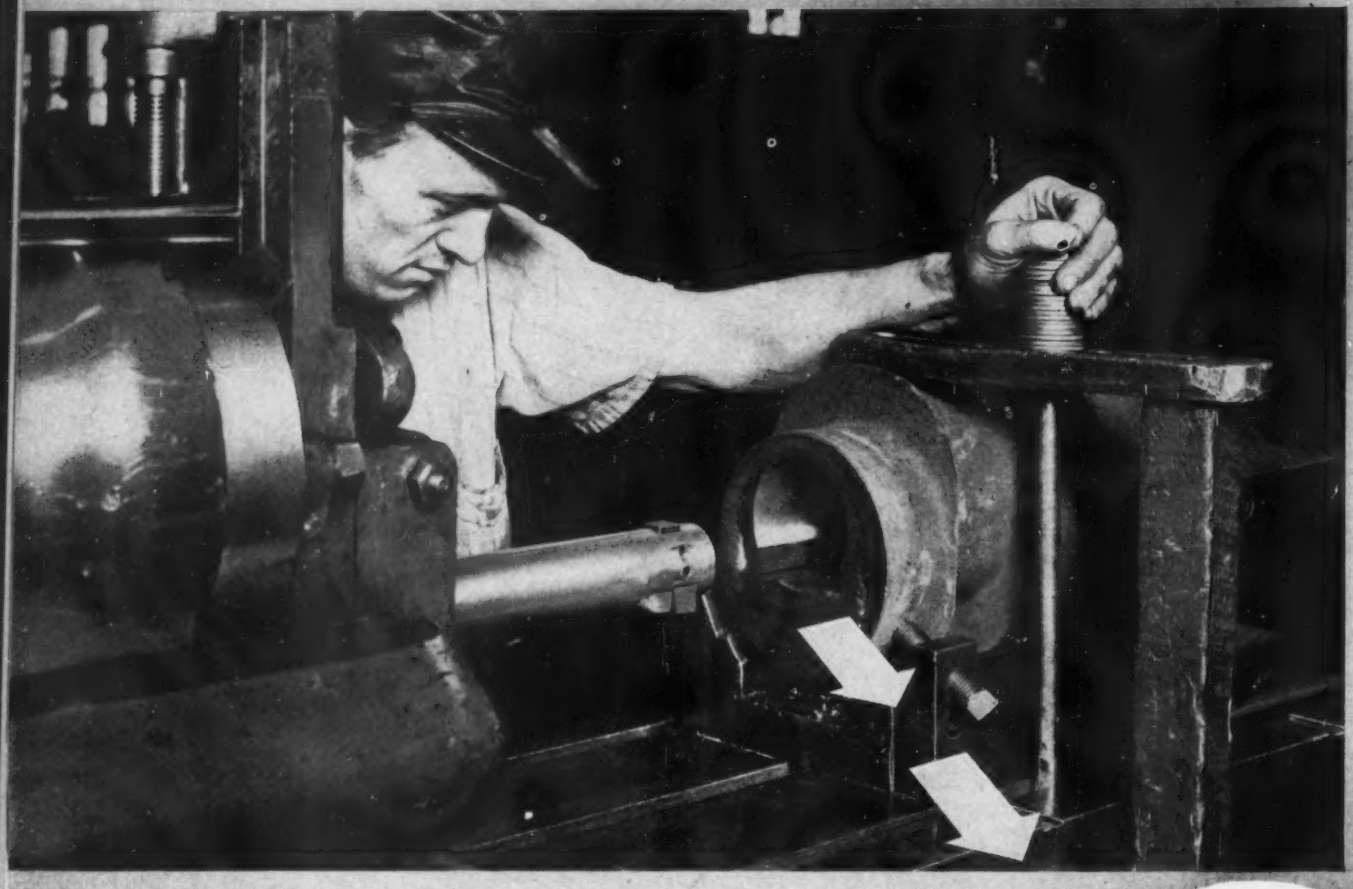
What about speculators who will grab up desirable machines at rock-bottom prices and hold them for later sale at higher prices? What about inventory losses suffered by those who have paid Clayton schedules for machines now offered at a fraction of former prices?

WAA's new price policy is ill-advised and ill-timed. But now that the step has been taken, the principal thing to do is to see that the damage is minimized. We should make sure that the government does not sell at a few cents on the dollar machines which should be retained for emergency and that old machines are really scrapped, not held in surplus at a heavy cost to taxpayers.

Finally, we should make sure that as much order as possible is preserved in surplus disposal.

Burnham Finney

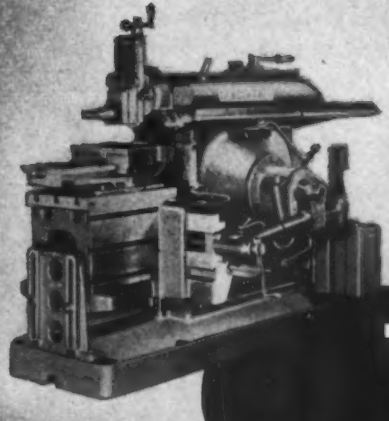
INTERNAL SHAPING...



In the field of internal shaping alone, Cincinnati Shapers are used on a long list of "hard to get at jobs"—from cutting internal key ways to cutting symmetrical and non-symmetrical holes.

We show a Cincinnati Shaper shaping internal key ways in a blind hole—a "hard to get at job." Remember, a Cincinnati Shaper, the tool of many uses, will always be busy in your shop.

Write for Catalog N-2, describing these powerful accurate Shapers.



THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

You Can't Run a Shop by Remote Control

It's oversee—or oversight—in handling men. Production is still a 50-50 job for management and labor—so shop executives can set the example by spending half their time seeing what's going on

BY E. J. TANGERMAN
MANAGING EDITOR

DURING ONE VISIT to his friend's hunting lodge, a businessman admired particularly a big setter, who sat in front of the fireplace, growling deep in his throat every so often, until the host said sharply, "Quiet, Works Manager!"

The next winter, the dog was still there, sitting and scratching until the host commanded, "Stop it, Vice-president and General Manager!"

"Look," said the guest: "A year ago, you called your dog 'Works Manager.' Now you call him 'Vice-president and General Manager.' Why?"

"I promoted him when he changed characteristics," said the host. "Last year, he used to sit on his tail and growl; now he just sits on his tail."

CASE I: This old story was recalled to my mind by a recent letter from a small-plant superintendent, who asks: "How much time should I spend in the shop?" He goes on to explain that his little company, up to a score or so years ago, had a superintendent who spent all of his time in the shop, supervising the men. He was eventually replaced by a former toolmaker, who spent most of his time in the shop, but did have a small office where he could lay out plans, have private talks with men, and the like.

In recent years, several different men have had the job, one an incompetent who didn't live up to his recommendations, another a good mechanic who couldn't get along with his men, so withdrew more and more into his office, the third a man inexperienced in shop operations who "took over to help out" and only visited the shop on an occasional "walk-through." Several subordinates actually ran the shop, reporting to the superintendent for instructions. The present man wanted my opinion of what he should do—continue with the subordinates' reports, or see for himself.

I believe he should see for himself—in detail. My own observations tend to bear out my feeling that management seems to be withdrawing from active contact with operations, attempting to direct by remote control from an air-conditioned ivory tower. Let's examine some additional typical cases:

CASE II: An old-time plant manager was replaced on retirement by a 40-year-old college-trained engineer who introduced the latest methods of time and motion study, quality control and production control. These he administers from the "front office" through an army of subordinates. His only visits to the plant are in the company of the owner, his only direct instructions are in the form of posted memos. In two years overhead and piecework costs have risen to a ridiculous extent, the men went on strike for the first time since the plant was built, and old-timers say: "The bosses don't give a damn about things out here. They don't even know what's going on, and don't care. They're just pulling down their big fat salaries while they can get away with it. They don't want any help or ideas from us, in fact are too good to talk to us. They don't know what it's all about, so why should we bust a gut working?"

CASE III: A manager complains: "Everybody calls the superintendent 'Joe,' but I'm 'Mr. Blank.' Why don't they call me 'Bill'?" Joe happens to be a guy who has done all the jobs he supervises, who still gets his white collar smudged up when the pinch comes. He's easy-going on the surface, makes it his business to know what his men are thinking about, what their personal troubles and triumphs are. Mr. Blank, on the other hand, is reserved and remote. When he comes out occasionally to check on production, with which he is unfamiliar, his appearance is stern, his manner that of a prosecuting attorney. The men are afraid to "open up." (*Next page, please*)

The works manager rolls up his sleeves . . .

CASE IV: A young executive applying for a better job in a small plant gave as his reasons for changing, "I am tired of the grease and grime, the sweat, and associating with men who are not my equals in education and background." As far as that prospective employer is concerned, the youngster can stay where he is.

CASE V: The president of a company is an incorrigible hobbyist and gadgeteer. A surprising number of his key employees are hobbyists and gadgeteers too. They have worked with him to develop tricky new instruments, plant improvements and whatnot. In spite of the obvious "inefficiency" resulting from men doing personal jobs on company time, production records are high, costs low, and company products are noted for originality and practicality.

CASE VI: A works manager frequently rolls up his sleeves and goes to work on a tough job. He's known as open to suggestion, is called "Bill" by everybody from office boys up, is forever taking plant and employee photos for company advertising and house-organ use. Most of his "executive" work he does at night and at odd hours. You guessed it: no labor trouble, good production records.

Latest methods of control . . . but no contact

CASE VII: A president has gone out of his way to produce ideal working conditions, sparks employee get-togethers and athletic events, etc., etc. Result: Negligible absenteeism and a very low separation rate.

CASE VIII: A superintendent did much of his own time-study work, using a stopwatch concealed in his pocket. After a while, he felt the times he was getting were overlong, that men actually slowed up while he watched. The mystery was solved when he stepped back into the punch shop just in time to hear one man yell to another: "Hey, Joe, the Old Man just went through with his stopwatch in his pocket again. Don't kill the job!" Abe Lincoln said once, "You can fool *some* of the people *all* of the time, and *all* of the people *some* of the time; but you can't fool *all* of the people *all* of the time."

CASE IX: A machine-shop foreman, cold and distant, acid-tongued, suspected most of his men were stalling. To catch them at it, he took to turning up suddenly, going out of the shop and coming right back in, and generally acting the amateur detective. Result: Stalling began in earnest; they stalled him out of his job.

CASE X: The production engineer sharply criticized shop men for modifying ridiculous tolerances and "interpreting" drawings. He ordered flatly: "I'll do the thinking; you just follow instructions." Result: They followed his drawings exactly—taking tolerances on the wrong side. Soon he had the fatal reputation of bungling everything he touched.

CASE XI: A bulletin was posted to the effect that engineering and tool design were the exclusive prerogative of the engineering department; no shop modifications or gadgets would be tolerated because product precision could not be risked in the hands of the untrained. Result: No cooperation between engineering and shop, loss of shop men with initiative and ideas, steadily rising costs. (This situation, as well as that of Case X, officially or unofficially exists in varying degrees in many plants.)

CASE XII: In one small single-floor machine shop, tool engineering, production control *and the desks of shop executives* are on a glassed-in mezzanine overlooking the shop. No excuse there for not knowing what's going on—everything is in full view. As a case in point, I walked in with a photographer and began to set up for some pictures. Within a couple of minutes, the works manager came up, introduced himself, and found out what we were up to. That's as it should be.

CASE XIII: The plant master mechanic maintained a daily log crammed with details of operations, design of equipment, ideas for changes and little happenings in the shop. Within a week, the general manager heard of it and insisted on a personal copy. Not only did it give him a bit-by-bit (hence digestible) picture of his plant, but also it kept him abreast of what was going on—gave him little items to use in his trips through. Case in point: Joe Jones was at the top of a high ladder fixing a lineshaft hanger. It was dark, so he carried a flashlight as well as his wrench and screwdriver. He needed both hands for one part of the job, so decided to hold his flashlight in his mouth. The flashlight grew too heavy for his false teeth, so they and the flash hit the floor together. Joe's uppers had to go out for repairs. Next time the Old Man went through the shop he stopped by and said, "Joe, when do the teeth come back?" Joe was properly tickled, and one more link in the chain of good employee relations was forged.

These 13 cases, in one form or another, you can duplicate from your own experience. Good cases V, VI,

False teeth and flashlight fell together . . .

VII, XII and XIII are all too rare; the other—and bad—ones all too common.

The proper shop arrangement has traditionally included shop offices in the shop. This is now frequently changed to get the superintendent, general foreman or equivalent nearer the other executives, both for convenience in messenger service and in indicating his importance in the executive lineup. Perhaps these two factors should be subordinated to the vital ones—employee relations and direct overseeing of production. It's oversee or oversight.

Perhaps I may be pardoned, in summing up these cases, for recalling the old story of the very-new, very-egotistical president of a prominent Illinois railroad who was startled one morning to have a section hand in working clothes walk unannounced into his office, with hat on head, and say, "Me name is Paddy Malone and I worruk down in the yar-r-r-ds. I wanted to tell you—."

But the president cut him off with: "Mr. Malone, this is the president's office. You are expected to make an appointment; when it is granted, to dress for your visit; to knock before entering; and to take off your hat when you come in. Now, go back and try again later. You'll find my secretary with her appointment book outside."

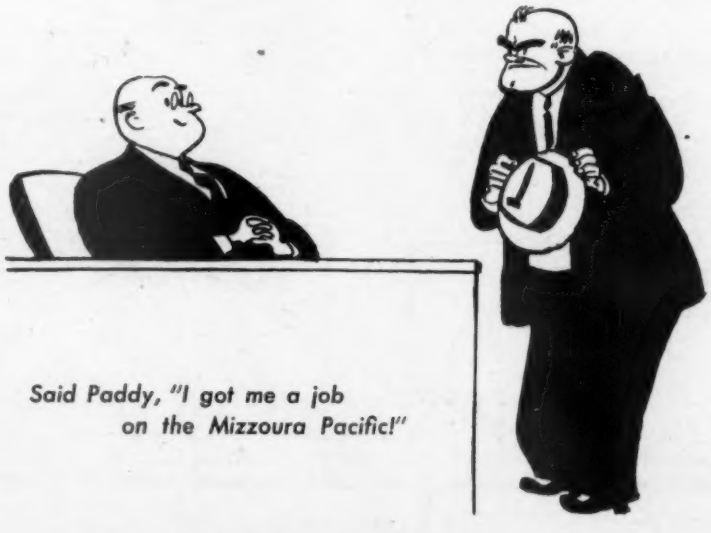
Paddy shuffled out. Next day, when the president's pad showed "P. Malone," there was a discreet knock on the door. When he called, "Come in!" Paddy entered quietly, hat in hand, the very picture of propriety. He waited near the door.

"Now, my good man, what can I do for you?" said the president, pompously.

"Yez can go to Hell!" said Paddy. "I got me a job on the Mizzoura Pacific."

Possible causes of the trend to the ivory tower? One may well be the increasing amount of engineering and paper work in shop operation. Conferences, reports, studies, control—all these mean time and paper, which may be overdone in a small plant. Such operations should be handled with minimum records and chartwork. The *executive* work should be done by the executive, the *clerical* work by clerks. Let's not confuse them.

Another cause is undoubtedly the trend toward college-trained management. Many engineering graduates are not exposed to physical labor either before or during their college careers. They develop an allergy to it, together with an artificial social code based on college tradition and fraternity custom. Any introduction to physical labor thereafter is distasteful—as are grease, noise, dirt, smoke and bad grammar. The cure is to rub their noses in it—just as is done with any offensive pup—but management hestitates to take so drastic a step until post-college



Said Paddy, "I got me a job on the Mizzoura Pacific!"

A 50-50 split between office and shop . . .

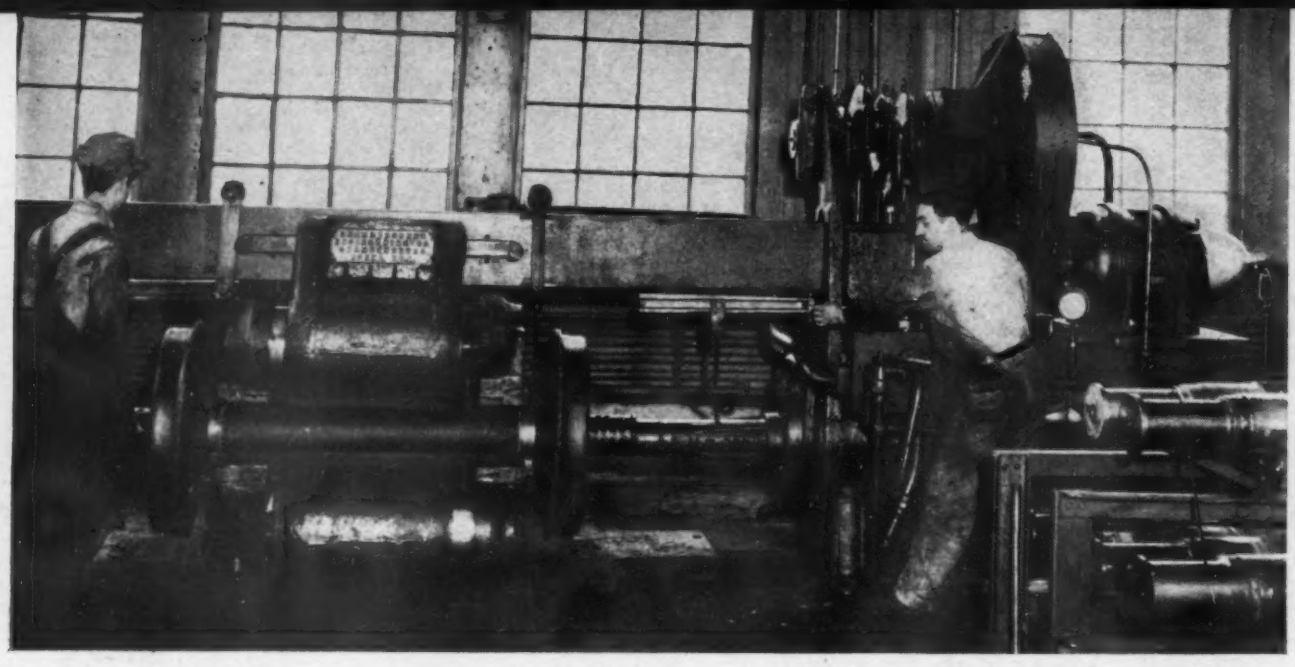
working habits are formed. (Add to this condition the sense of power and authority enjoyed by so many recently deactivated young officers.)

But let's go back to our original question: How much time should a shop executive spend in the shop?

Obviously, the conferences, planning and paper work of modern industrial practice must be carried on to a necessary extent. The day of the public bawling out, the on-the-scene strategy huddle, and the records chalked on the shop door is gone. But let's say that the white-collar activities be set at not more than half a shop executive's time (with a good clerk, male or female, it can be less). That leaves half of the time in which management can manage, superintendents can superintend and supervisors can supervise. That's a 50-50 split. If it's true that a good management policy is to go 50-50 with labor, the same split ought to apply to shop management's time.

One word of caution is certainly in order here. The foreman or supervisor is charged with the responsibility of directing his men. Nothing the superintendent or works manager says or does should preempt or depreciate that authority. Shop management, to be successful, must follow the old military principle of chain of command, but the superior officer can always observe and pass suggestions down the line. He can also talk with individuals to keep himself in touch with what's going on, meantime conveying, first hand, management thinking on any problem under discussion. That builds worker confidence. He does a badly needed liaison job while he avoids ivory-tower thinking and remote-control management.

What are your opinions and experiences in this connection? Other readers will be interested.



Wheels are stripped from axles on a 600-ton stripping press at receiving end of the shop. Collets protect the journals during stripping, as well as in mounting

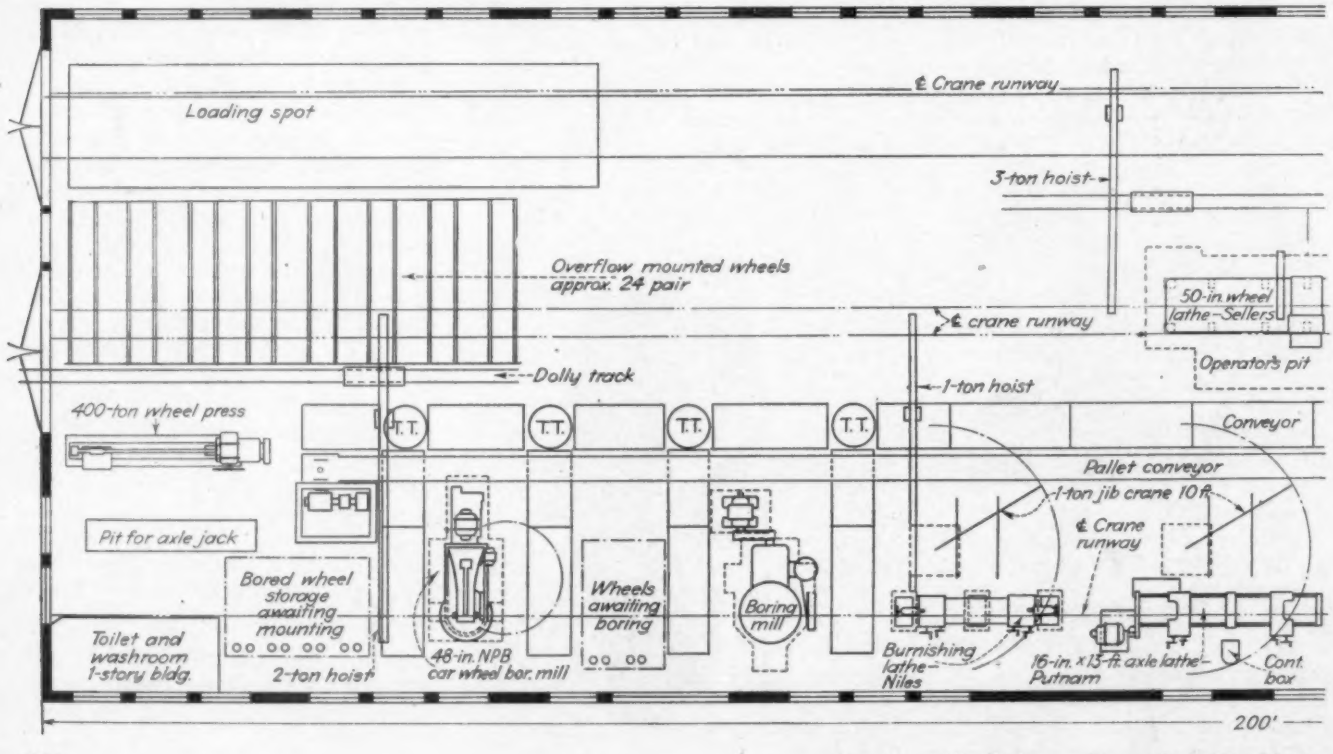
Car-Wheel Maintenance Mechanized . . . I

PLANNED as a part of its long-range program of plant modernization, the Pittsburgh Glenwood wheel shop of the Baltimore & Ohio Railroad consolidates wheel maintenance activities, such as stripping, boring, mounting, tread turning and journal truing. Placed in service early this year, it has been laid out to require a minimum of human effort while axles and wheels are routed through with the efficiency and economy of a modern assembly line.

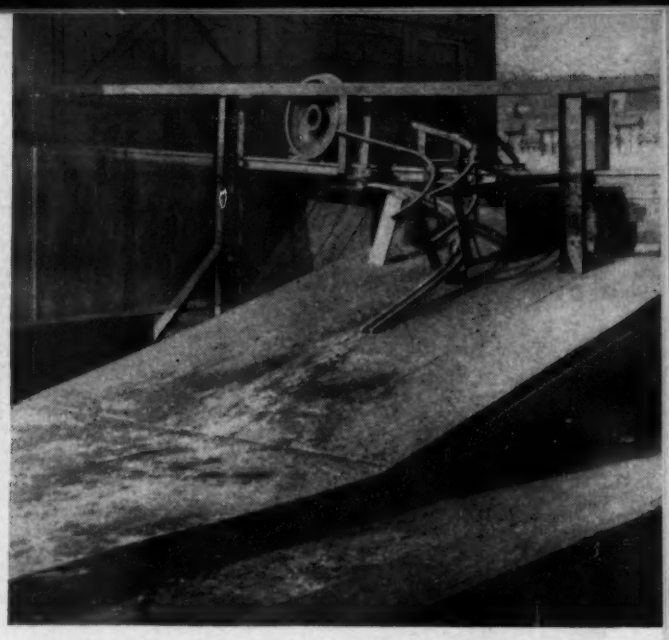
With the building available, the principal problem was to obtain a practical arrangement of machinery and a serviceable materials-handling system. Based on both cranes and conveyors, the materials-handling system has been integrated so axles and wheels move smoothly from receiving through storage and shop to shipping.

Used wheels and axles with unscored journals are received in carloads from various divisions served by the plant. Unloaded on storage

LAYOUT OF GLENWOOD WHEEL SHOP shows the in-line arrangement of machines, wheel and axle



Wheels, resting in dollies, are slipped from the axle, supported by a tong hook and electric hoist. Each wheel is raised by elevator to the storage-bin runway



Used wheels are routed into any one of three storage bins by switches air-operated from valves near the elevator inside the shop

New plant layout with modern materials - handling equipment permits wheel reconditioning with economy of an assembly line

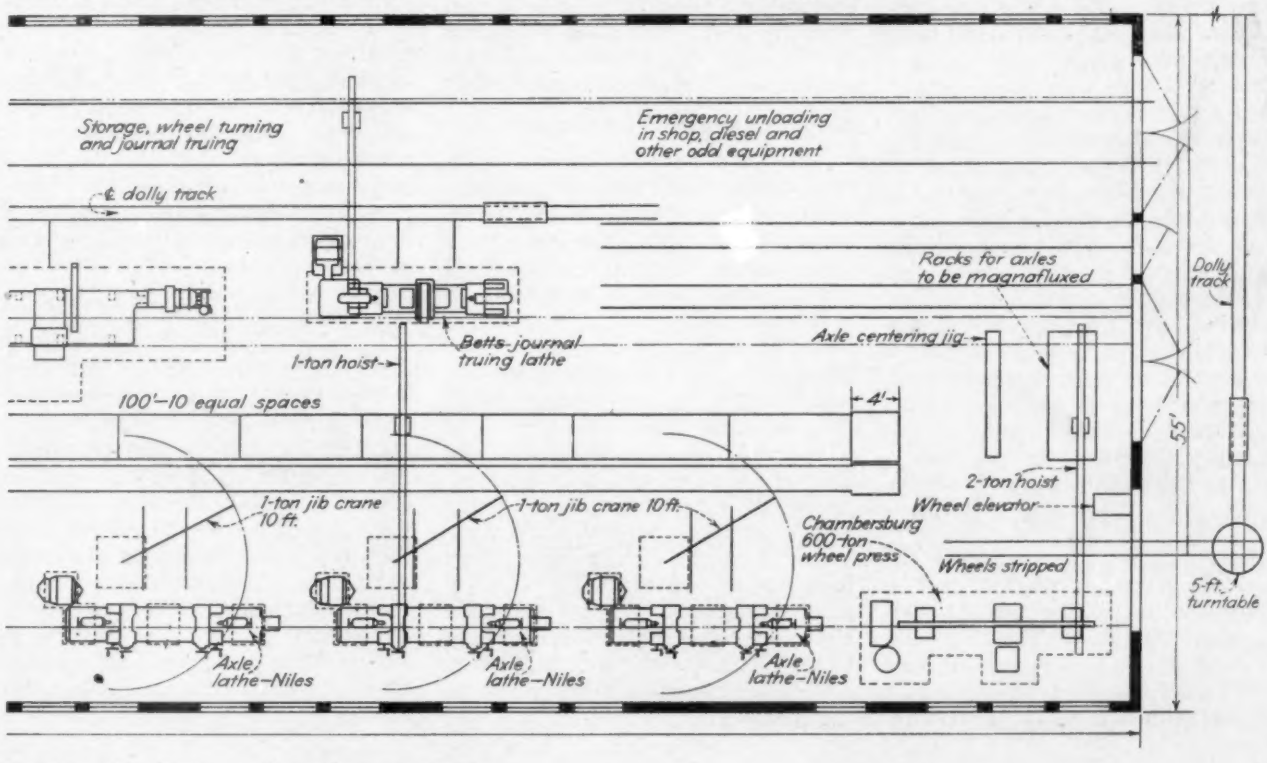
BY LAWRENCE W. SAGLE

tracks at the east end of the shop, wheels are inspected, placed on roller-bearing dollies and brought direct to a Chambersburg 600-ton stripping press which removes both wheels at the same time. As on the mounting press, perforated collets are placed over the journals to protect them during the operation. Output of this press is 100 pairs of wheels in 8 hr.

After the wheels are pressed loose, wheels and axle are rolled out of the press. The wheels are placed on special dollies that operate on a track below the floor level. The axle is then suspended on an electric hoist and the wheels, standing in a groove in the sub-floor dolly, are moved aside, freeing the axle.

Wheels, marked by an inspector for reuse or scrap, are raised by a pneumatically operated elevator to a chute where they roll by gravity along a runway to storage bins. Leads, or switches, on the runway are controlled by air valves alongside the elevator shaft. This permits the operator to direct wheels for reuse to the end storage bin and those to be scrapped to either of the

conveyors for movement between operations and crane coverage for shop and individual machines



Axles are carried through the shop on a 154-ft. pallet conveyor and are handled by tramrail and jib cranes from racks to machines

CAR-WHEEL MAINTENANCE MECHANIZED (continued)

two remaining bins along the runway.

A special appliance, or brake, retards the speed of reclaimed wheels to prevent damage as they roll to the storage bin. Wheels are then held at the bins for joint inspection by the master car builder and a representative of the wheel manufacturer. As fast as they accumulate in sufficient quantities, scrap wheels are loaded direct from bins into gondola cars by an American diesel locomotive crane equipped with an electromagnet.

Axles to be reused are moved by hoist to an axle rack for inspection, recentering and calipering of wheel seats to step sizes. Scrap axles are removed to scrap storage by an especially designed axle wagon, which can be handled by one man.

A single-end, electrically driven centering machine recenters the axle. Intended as a replacement, a new double-end centering machine is being developed on which both ends of the axle can be centered simultaneously. It will also be possible to recenter axles with mounted wheels.

Wheel Seat Step Sizes

The required diameter of the finished wheel seat is marked on the axle according to the nearest step size in 1/32-in. steps. The allowable variation for wheel-seat diameters between the new oversize dimension and shop limits is ⅜ in. Therefore, 13 step sizes of 1/32 in., numbered 1 to 13, can be obtained on each size of axle. For example, on a 5 x 9-in. axle, the shop limit for the wheel-seat diameter is 6¼ in. Thus, wheel-seat size No. 2 is 6 9/32 or 6.281 in. Both wheel seats of each axle are turned to the specified size in the axle lathe. A chart, showing the number of axles available for each step size, is supplied boring-mill operators who bore the wheels to suit, allowing proper tolerance to obtain the required mounting pressure for the extremely tight fit needed.

Axle Cranes and Conveyor

Axles are handled by six overhead Cleveland tramrail cranes, equipped with electric hoists, which cover the complete shop area. Four cranes serve the left side of the shop. The two end cranes in this line, each of 2-ton capacity, serve the stripping and mounting presses, while the other two, each of 1-ton capacity, handle axles to and from racks at the axle and burnishing lathes.

The two cranes on the right-hand side of the shop, each having a capacity of 3 tons, handle mounted wheels to and from the wheel-turning and journal-truing lathes, and load and unload the wheel cars inside the shop. In addition to these six cranes, five 1-ton jib cranes are located at the axle and burnishing lathes to lift axles from racks to the machines.

Axles that have been recentered and marked with the finish wheel-seat size are stacked on racks located near the axle lathes. Each rack has a capacity of 24 axles and is loaded at starting time.

After leaving the axle lathes, the axles are carried by conveyor to the Magnaflux machine, then to the burnishing machine and from there to the mounting press. The conveyor is a 154-ft. Mathews motor-driven pallet conveyor, controlled by push-buttons at each lathe and at the mounting press, six altogether. An automatic cut-off switch at the end of the conveyor prevents overrun and damage to conveyor and axles.

Axle Reconditioning

Three of the four axle lathes are new Niles No. 3, double-end, center-driven units with an equalizing chuck equipped for fine feeds, starting with 1/64 in. (3/64 in. usually being selected). They have a speed range of 25 to 125 rpm., with a micrometer dial for cross-feed. The fourth is a rebuilt Bridgeford lathe. Lathes are tooled with modern cast-type cutting tools and the present average output per lathe is 120 axles in an 8-hr. day.

The wheel seats and journals of all axles are turned. The wheel seats are machined to exact step dimensions as previously marked on each axle, the diameter being calipered with an outside dial micrometer. Carbide and other tools are designed for continuous 8-hr. operation without regrinding.

After the wheel seats and journals have been turned, the axles are moved to the Magnaflux machine for inspection by the dry method. This operation will be replaced later by use of a Magnaglo machine, now being developed, that will employ a paste suspended in oil. The inspection, made under black light in a dark place, will show cracks or flaws in fluorescent form and is expected to take less time than now required with the present method.

Axles are burnished on a burnishing lathe, a Niles double-end type, with opposed Stellite burnishing rolls and Neilson Timken-bearing tailstock integral centers. Output of this machine at 75 to 150 rpm. is 48 axles in 8 hr. If necessary, axles may also be burnished on either of the four axle lathes, as they are equipped with opposed type burnishing attachments.

Part II on wheel-and-axle maintenance will be published in a forthcoming issue.

TALKING SHOP

Thirsty?

A FRIEND of ours attended a recent technical session in Montreal. Good hosts took him to a famous Montreal restaurant, which incidentally was more French than anything in France. As he approached his third course and his third brand of wine, our friend decided that a good drink of water might be refreshing. He asked for it. The waiter, bowing from the waist, asked: "Why? Is someone dirty?"

Stymied

ON THE MORE serious side of the Montreal picture are the results of the belated tide of strikes hitting that city. Locomotive production, a vital part of the city's industry, was so slowed up by strikes that cancellation of foreign orders followed. This, in the opinion of many, is business that may be difficult to get at a later date. The people in war-wracked countries may not have much money—but they are in a hurry. And strikes have hit the veterans' building program up there; they have everything but nails.

Accuracy in Waiting

WE'VE heard considerable complaint about the accuracy that can be obtained in machining molded plastic parts. Plastics are affected to a much greater extent by temperature and humidity than metals. But, most important, plastics, like metals, need aging. Many operators start machining the plastic part too soon after molding. If you wait 24 hr. before machining the part should stay within 0.002 in. Where greater accuracy is required, parts should be stored up to six weeks. It's all a matter of patience and inventory.

Grandma's Doing Good

WHEN grandma used to get those lovely butterballs from rolling them around on two flat paddles, she was using the principles responsible for the balls in modern ball bearings. Quality of balls has improved steadily, but received its greatest boost from the aircraft industry, or more specifically from the Norden bombsight. The 1-mm. balls turned out for this program are the smallest yet made. They're useful in peacetime too, and one of the biggest applications is on our ball-point pens. In ball bearings they had high self-lubricating qualities; as pen points, excellent inking properties.

Acid Touch

A SKI-MEISTER friend of ours tells of a minor mystery in the plant where he worked during the war. They had developed a very tricky heat-sensitive fuze. Initial tests were highly satisfactory, so a production line was set up. Girls were almost mandatory, because every wire, every part, had to be exactly measured and assembled to weight. But every one of the first 300 fuzes was rejected as inoperative.

Checkup showed failure was caused by shorting of a condenser, from acid corrosion. Much double-checking indicated the girls should wear gloves, because female perspiration turns acid in reaction during the monthly menstrual period. More than a woman's tongue is acid.

Another similar case is reported by E. O. Schreve of G. E. At an Iowa plant welding stainless-steel exhaust manifolds for aircraft engines, some assemblies emerged from annealing furnaces with corrosion-pitted surfaces. You guessed it—girl welders. If you handle them with gloves, have them handle work that way.

Beware P-Materials

C. L. BAKER is building houses in Port Richey, Fla., of 7-in. palm-trunk sections cemented together. Material cost for a bungalow is only $28. Major problem is sawing up the light, but abrasive, palm trunks. The circular-saw blade must be resharpened after every log. That's why people use carbides, Mr. Baker.

DAFFYNITUS in its most serious form has brought forth the following results from the editor of the *McGraw-Hill Digest*, an electrical engineer:

BORING BAR—Saloon with a talkative bartender.

SHAPER—Straight jacket with two-way stretch.

CUTTING OIL—Flattery with a double meaning.

CHIP BREAKER — The jerk who slammed his cards on the table when he didn't fill an inside straight.

JIG—An ants-in-the-pants dance.

FILLET—What you make no bones about eating on Friday.

CENTERLESS GRINDER — Burlesque dancer with free-wheeling.

CHUCK—By any other name Charlie wouldn't be known.

PLANER—A guy with a pilot's license.

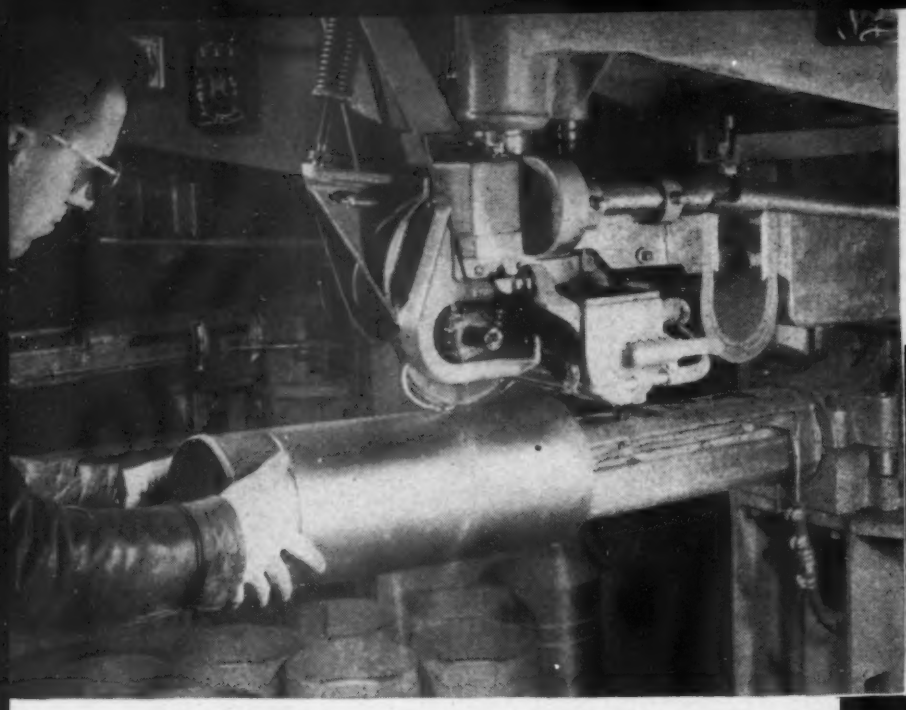
BAND SAW—Bass fiddle in a dance orchestra.

White Lies

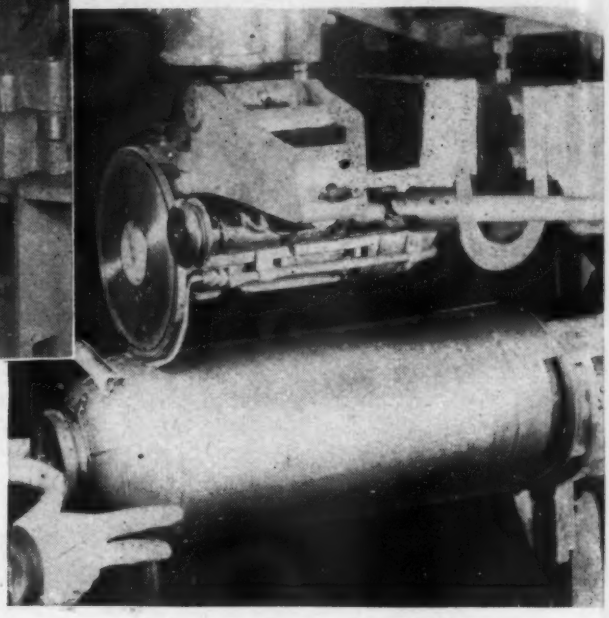
SEVERAL war-born products do so well in peacetime applications that makers are afraid to confess just how good they are. As one maker said recently: "We can go to Ford and claim this job will work 5% better, and Ford will buy it. But if we tell the truth—that it's 700% better—they'll throw us out as liars."

Pace of Progress

AT ABERDEEN Proving Ground, Ordnance officers played for us the sound track from a Doppler-effect tracer of the flight of a V-2. They call it the "whistle of the missile." It was all too complicated for us to understand, but the clincher was the statement that radar and other tracking equipment for airborne devices is good for only about three flight tests. Within that period, either the missile or the tracking device has been improved so much the equipment is obsolete.



Fabrication of the fire extinguisher (below) requires a longitudinal seam welder for one seam and a transverse or circumferential welder for joining the top to the center section. A flood of water is constantly directed on the seam weld



Welding speed selection, control of overlap, electrode and drive sizes and supporting fixtures improve seam-welding technique

RESISTANCE WELDING OF STAINLESS STEELS...2

Seam-Welding Variables

BY J. J. RILEY, THE TAYLOR-WINFIELD CORPORATION

SEAM-WELDING [in which overlapping spot welds are made progressively along a joint by circular electrodes (wheels)] of stainless steel applies the same welding fundamentals as spot-welding, but there the parallel stops. The rate of joining in seam-welding is so high that the work accumulates more heat, cools less rapidly and, with ferritic stainless, is more liable to grain growth and brittleness. With austenitic stainless, this higher working temperature increases carbide precipitation and produces more buckling, warping and distortion.

The principal means of reducing working temperature is flooding cool water on the upper and lower surfaces of the weld while it is being made. Further temperature reduction can be made by limiting the number of spot welds per linear inch of joint. A pressure-tight joint will require a minimum number of spot welds per inch, approximately 12 for 0.010-in. to 5 for 0.125-in. thick steel.

Seam-welding may be of three types:

Longitudinal—where the seam weld is made in a direction essentially parallel to the throat depth of the welder.

Transverse—where the seam weld is made in a direction essentially at right angles to the throat depth of the welder.

Roll-spot—where a spaced series of separate spot welds are made on a joint that does not have to be pressure tight.

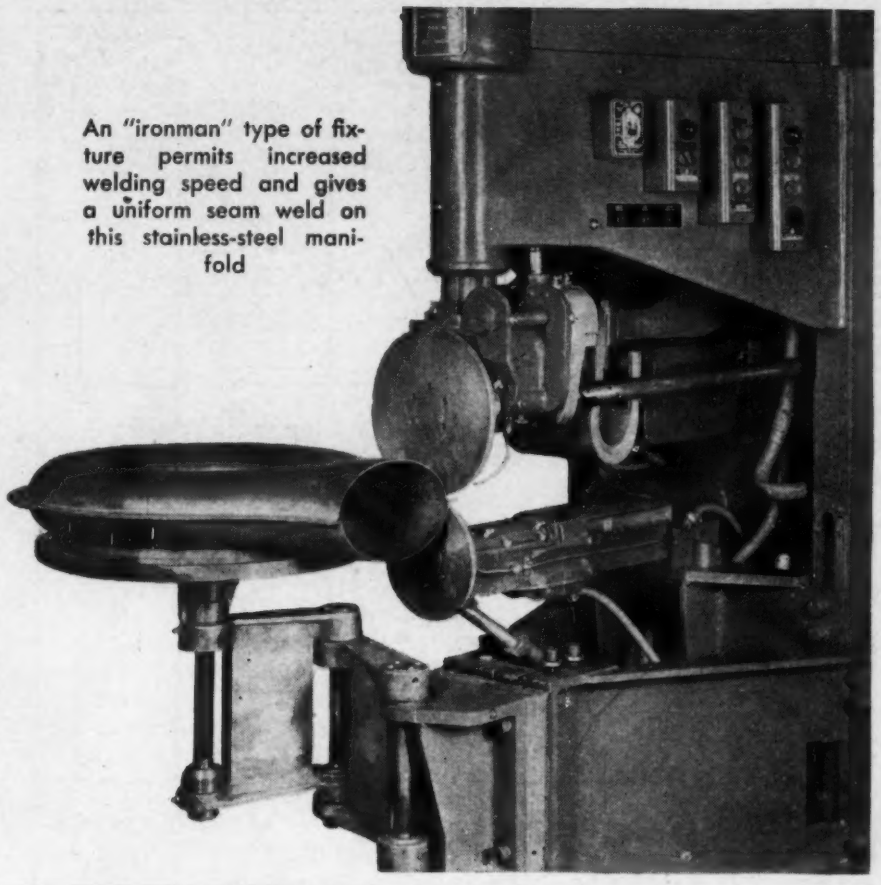
Seam welds in stainless steels are generally confined to lap joints. The

overlap must be sufficient to prevent excessive burning of the edges of the work by welding heat, too much expulsion, "spitting" of molten metal and excessive weld deformation.

As the center of the welding electrode should be guided along the center of the overlap, the complicated shape of some welding assemblies would require unnecessarily slow welding speed if the operator had to support the work and also guide the welding. Supporting fixtures permit greater welding speed and consistency of results.

Pre-spot tacking facilitates control of the overlap while welding, and prevents warping, skidding or creeping of the joint edges. Overlap on longitudinal seams may be conveniently set by a Z-bar.

In welding along a continuous curve, such as a flanged bottom for a cylindrical container, minimum electrode diameter should be limited to recommended values for longer electrode life. Where the line of welds proceeds at right angles by turning a corner, minimum recommended radii are 2 in. for stainless-steel thicknesses from 0.030 to 0.050



An "ironman" type of fixture permits increased welding speed and gives a uniform seam weld on this stainless-steel manifold

STAINLESS STEEL SEAM-WELDING VARIABLES

DATA COMMON TO ALL WELDING SPEEDS									PRESSURE TIGHT JOINT													NON-PRESSURE TIGHT JOINT (ROLL SPOT WELDING)				
									RECOMMENDED MAXIMUM WELDING SPEEDS					RECOMMENDED AVERAGE WELDING SPEEDS					RECOMMENDED MINIMUM WELDING SPEEDS							
Thickness of each of the two work pieces		Electrode Width and Shape (Note 10)		Electrode Width and Shape (Note 10)		ELECTRODE FORCE		Min. Contacting Overlap L	Heat Time	Cool Time	Welding Speed	Welds per Inch	Welding Current	Heat Time	Cool Time	Welding Speed	Welds per Inch	Welding Current	Heat Time	Cool Time	Welding Speed	Welds per Inch	Welding Current	Heat Time	Cool Time	WELDING SPEEDS In. per Min.
In.	USS Gauge	d in.	Min. D in.	Radius in.	Min. D in.	Min. lbs.	Normal lbs.	Note 4 in.	Note 5 Cycles	Note 5 Cycles	In. per Min.		Amperes	Note 5 Cycles	Note 5 Cycles	In. per Min.		Amperes	Note 5 Cycles	Note 5 Cycles	In. per Min.		Amperes	Cycles	Cycles	Max.	Avg.	Min.
.006	38	1/8	3/8	1-1/2	3/16	300	300	1/4	1	1	90	20	6,300	2	1	60	20	4,000	2	2	44	20	3,600	2	*	160	120	80
.008	35	3/16	3/8	1-1/2	3/16	330	350	1/4	1	1	90	20	6,400	2	1	60	18	4,600	2	3	40	18	4,150	2	*	160	120	80
.010	32	3/16	3/8	1-1/2	3/16	375	400	1/4	1	1	90	20	6,600	2	2	60	16	5,000	3	2	44	16	4,500	3	*	160	120	80
.012	30	3/16	3/8	1-1/2	1/4	425	450	5/16	2	1	80	15	6,800	3	2	55	15	5,600	3	3	40	15	5,050	3	*	160	110	80
.014	29	7/32	1/2	1-1/2	1/4	470	500	5/16	2	1	80	15	7,200	3	2	55	14	6,200	3	3	42	14	5,600	3	*	160	110	80
.016	28	7/32	1/2	1-1/2	1/4	550	600	5/16	2	1	80	15	7,600	3	2	55	14	6,700	3	3	43	14	6,000	3	*	160	110	80
.019	26	1/4	1/2	1-1/2	1/4	600	650	5/16	2	1	80	15	8,300	3	2	55	13	7,300	3	3	34	13	6,500	4	*	160	110	80
.021	25	1/4	1/2	1-1/2	1/4	650	700	3/8	2	1	80	15	9,000	3	2	55	13	7,900	3	3	44	13	7,100	4	*	160	110	80
.025	24	1/4	1/2	3	3/8	775	850	7/16	2	2	75	12	12,000	3	2	50	12	9,200	3	5	38	12	8,300	5	*	150	100	75
.031	22	1/4	1/2	3	3/8	900	1000	7/16	2	2	75	12	13,500	3	3	50	12	10,600	3	5	38	12	9,600	5	*	150	100	75
.040	20	1/4	1/2	3	3/8	1050	1300	1/2	3	2	70	10	14,500	3	4	47	11	13,000	3	6	36	11	12,300	6	*	140	94	70
.050	18	5/16	1/2	3	1/2	1200	1600	5/8	3	2	65	11	15,500	4	4	45	10	14,200	4	6	36	10	13,500	7	*	130	90	65
.062	16	5/16	1/2	3	1/2	1400	1850	5/8	3	2	60	12	16,000	4	5	40	10	15,100	4	6	36	10	14,500	8	*	120	80	60
.070	15	5/16	1/2	3	5/8	1600	2150	11/16	4	3	56	9	16,400	4	5	40	9	15,900	4	8	34	9	15,700	10	*	116	80	55
.078	14	3/8	5/8	3	5/8	1700	2300	11/16	4	3	56	9	16,800	4	6	40	9	16,800	4	9	31	9	16,800	10	*	112	80	50
.094	13	7/16	5/8	3	5/8	1800	2550	3/4	5	3	55	8	17,000	5	5	40	9	16,600	5	8	31	9	16,600	12	*	110	80	40
.109	12	1/2	3/4	3	3/4	1900	2950	13/16	5	3	53	8.5	17,300	5	7	38	8	16,800	5	12	27	8	16,800	14	*	106	76	30
.125	11	1/2	3/4	3	3/4	2000	3300	7/8	5	4	50	8	18,000	5	6	38	8	17,000	6	13	24	8	17,000	15	*	100	74	25

NOTES:

1 Types of steel—301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347, and 349.

2 Electrode material is RWMA Class 3 alloy.

3 Surface of steel is free from grease, scale or dirt.

4

5 Heat and cool times are indicated in cycles of 60 cycle frequency.

6 Electrode force does not provide for force to press ill-fitting parts together.

7 Use maximum electrode force at maximum speed and when welding cold worked material of 150,000 PSI or above ultimate tensile strength.

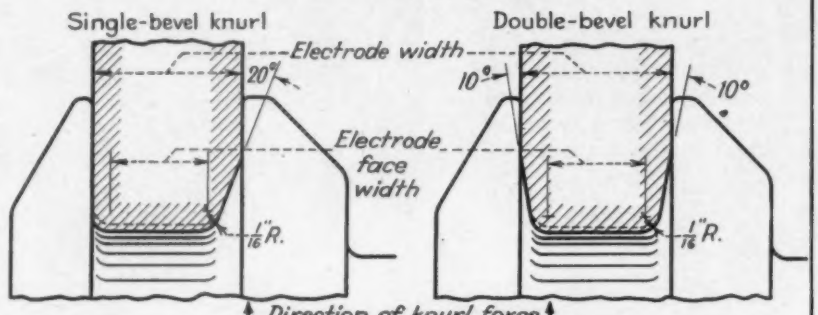
8 For large assemblies minimum contacting overlap should be increased by 30% for ease of guiding.

9 Large assemblies should be welded at the slower speeds for ease of handling and guiding.

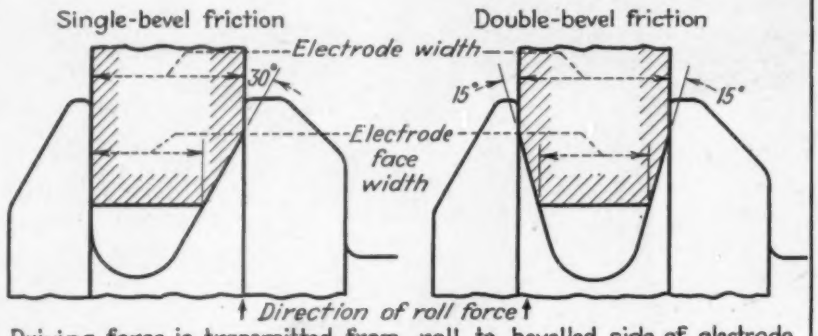
10 For best appearance use radius faced electrodes. Average application can be welded with flat face electrodes.

*Adjust the cool time to give the desired spot spacing.

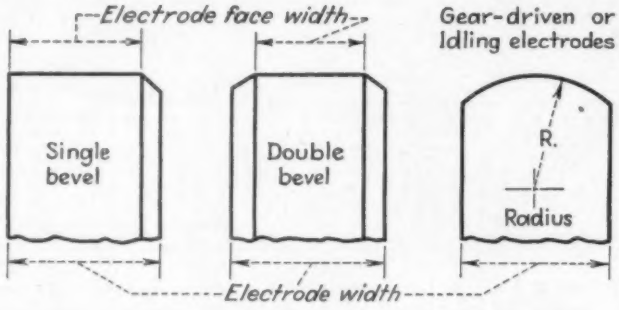
ELECTRODES AND DRIVES



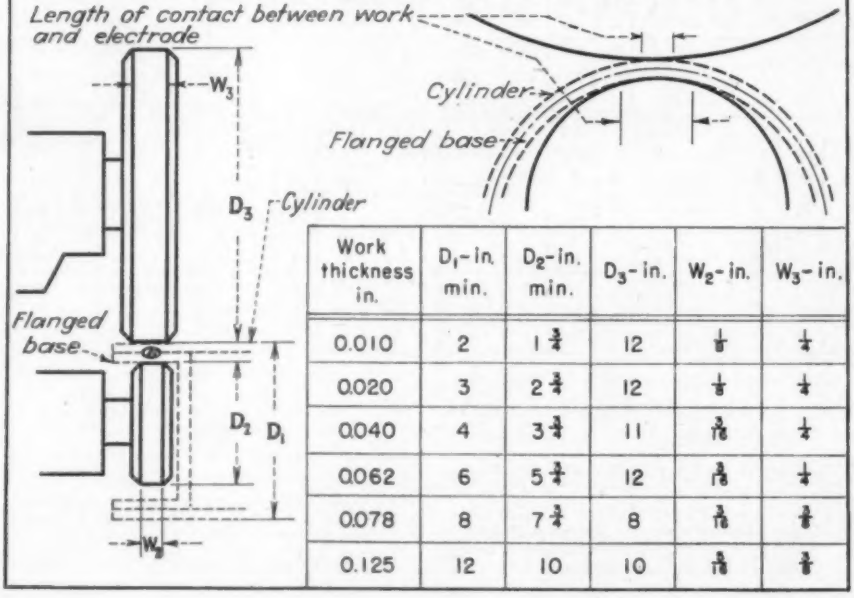
Driving force is transmitted from knurl to face of electrode



Driving force is transmitted from roll to bevelled side of electrode
Electrode should never bottom in drive roll



RECOMMENDED ELECTRODE AND WORK DIA.



Work thickness in.	D_1-in. min.	D_2-in. min.	D_3-in.	W_2-in.	W_3-in.
0.010	2	1 3/4	12	1/8	1/4
0.020	3	2 3/4	12	1/8	1/4
0.040	4	3 3/4	11	3/16	1/4
0.062	6	5 3/4	12	3/16	1/4
0.078	8	7 3/4	8	3/16	3/8
0.125	12	10	10	3/16	3/8

in., 2¼ in. for 0.062-in. thickness, 2½ in. for 0.78-in. thickness and 3 in. for 0.094 to 0.125-in. thickenesses.

Standard seam welders are classified by the type of weld as longitudinal or transverse, although some are built to perform both functions. The second major distinction depends on the type of electrode-driving mechanism. If the electrode is driven on the periphery by a steel roll, it is knurl or friction-driven; if through a train of gears, it is gear-driven. Sometimes one electrode is power-driven while the other one idles. Contour of a seam-welder electrode may be adequately preserved by driving through a hardened steel roll.

Contour of the idling electrode is selected to give long life without using the steel roll. Contour of peripherally driven electrodes varies among manufacturers but the driving force must always be properly transmitted to the electrode to make it rotate consistently under loads. Gear-type mechanisms are used when work clearances do not permit peripheral driving mechanisms.

Although a knurl maintains shape of the electrode face better, it marks the work with uniform ridges and electrode indentations, which are undesirable on most stainless-steel applications. With friction or gear drives, uniform ripples result from current interruption.

Reducing Surface Marks

Radius-crowned electrodes provide best weld appearance but flat-faced, beveled-side electrodes may be used for the average application. Where parts of approximately equal thicknesses must have minimum surface marking on one side of the weld, the electrode in contact with this side should have a face width at least 50% greater than that recommended.

If applications require electrodes of different diameters, the diameter of the top electrode must provide a clearance between the horns of the welding machine carrying the bearings. Different diameters cause different areas of the weld surfaces to be in contact with each electrode. By changing face widths to equalize the areas, excessive marking by the top electrode is prevented.

Welding force is usually applied by an air cylinder. The higher recommended value of electrode force should be used if the stainless steel has been cold-worked or when welding at the maximum recommended

speed. Parts must not be so poorly formed that electrode force is necessary to make them contact properly.

Interrupted current timing is used in seam-welding stainless steel, and periodic impulses of current are obtained by using an electronic current interrupter or timer. This intrerrupter allows current to flow for several cycles (the current "Heat" time) and to stop flowing for several cycles (the current "Cool" time) and repeats the "Heat-Cool" pattern as long as the control is actuated. In commercial seam-welder timers, the timing pattern of "Heat-Cool" time intervals is usually indicated in cycles of 60 cycles per second frequency, which is the frequency of most power systems.

In seam-welding stainless steel, a synchronous timer prevents inconsistent weld results caused by uncontrolled current transients, erratic timing, and provides less power-line disturbance. Good welds result when the "Heat" and "Cool" times are nearly equal. If unusually slow welding speeds are necessary because of the shape of the work, the current "Cool" time should be increased to decrease the number of welds per inch and avoid excessive heat input. Selection of speed depends principally on the ability of the operator to guide the weld at this speed and on the electrical capacity of the welding equipment.

For a given material and specific thickness combination there is a maximum welding speed, independent of the mechanical or electrical capacity of the equipment, or of handling requirements, which is determined solely by the characteristics of the seam-welding process. There is a maximum rate of heat input, limited in part by surface burning of the steel, which cannot be exceeded as the metal which is raised to the welding temperature will not cool sufficiently before the weld has moved from between the electrodes. Thus, the weld cools off without taking the electrode force and gives inconsistent results.

The semi-molten metal also tends to stick to the electrodes and cause excessive pickup. Consequently, increasing the kva. capacity of the welding transformer, which allows greater welding current and rate of heat input, does not permit higher welding speeds if a maximum welding speed has been reached.

Simple mathematical expressions needed to change some of the accompanying tabular data to the welding machine adjustments are:

$$\text{Number of Spot Welds per min.} = \frac{\text{Cycles in a Minute (3600 for 60 cps.)}}{\text{("Heat" time in cycles)} + \text{("Cool" time in cycles)}}.$$

$$\text{Welding Speed, (in. per min.)} = \text{Diameter of Electrode (in.)} \times 3.1416 \times \text{Electrode rpm.}$$

$$\text{Number of Welds per in.} = \frac{\text{Number of Welds in 1 min.}}{\text{Welding Speed in in. per min.}}$$

Selection of kva. rating for a seam-welder follows the same general procedure as for a spot-welder. An example is seam-welding 2 pieces of 0.050-in. thick stainless steel at the rates of 65 and 45 in. per min. By selecting welding variables from the table of variables, the kva. necessary for 65 in. per min. works

TROUBLE SHOOTING IN STAINLESS

TROUBLE	CAUSE	REMEDY
Hot metal "squirts" or "spits" out between the parts being welded.	Welding current is too high, or welding force is not high enough for current used.	Lower transformer tap switch one step or decrease heat dial setting. Increase air pressure in operating cylinder.
Uneven heating.	Overlap flange width is too small. Welded parts do not fit properly.	Redesign parts with proper overlap and correct forming operations.
Surface of parts are burned and pitted.	Electrode face width is too small or not correctly shaped. Welding electrode is made of copper alloy having too much electrical resistance. Surfaces of welded parts are covered with excessive scale, dirt, or foreign matter. Flow of cooling water is too weak or not directed at weld.	Reshape electrode to proper face width. Substitute an electrode of higher conductivity. Degrease parts or pickle them to remove grease, scale and dirt. Increase quantity of cooling water and properly direct it.
Steel adheres to the electrodes.	Electrode face width is too small or not correctly shaped. Welding speed is too fast for thicknesses of steel being welded.	Reshape electrode to proper face width. Decrease the rpm. of the electrodes.
Work does not weld at all.	Welder settings have not been changed from those for welding thinner sheets.	Reset welding variables for thicker sheets.
Decreasing depth of heating as weld progresses.	Magnetic material is being fed into the welder throat and reducing the welding current.	Use additional current regulating control or weld one half length of joint, reverse and weld other half.

out as: Number of welds per min. =

$$\frac{3600}{3+2} = 720$$

$$\text{Duty Cycle} = \frac{3(270)}{3600} = 0.60 \text{ or } 60\%$$

It takes 2.75 volts to force 15,500 amp. of welding current around the 18-in throat (depth) welder.

$$\text{Kva. Rating} = \sqrt{2(.60)} \times 42.7 = 47 \text{ kva.}$$

Following the same procedure for **45 in. per min.:**

Number of welds per min.

$$= \frac{3600}{4+4} = 450$$

$$\text{Duty Cycle} = \frac{4(450)}{3600} = .50 \text{ or } 50\%$$

It takes 2.50 volts to force 14,200 amp. of welding current around the 18-in throat (depth) welder.

$$\text{Kva. Rating} = \sqrt{2(.50} \times 35.3 = 35.3 \text{ kva.}$$

Welder ratings in kva. are predicated upon using the primary tap, which produces the highest secondary voltage of the transformer. Most transformers are built with tap switches to select taps to obtain different secondary voltages, and consequently different welding currents to cover a range of work thicknesses. Copper wire in the primary coils of the transformer is selected so the kva. rating varies in direct proportion to the secondary voltage.

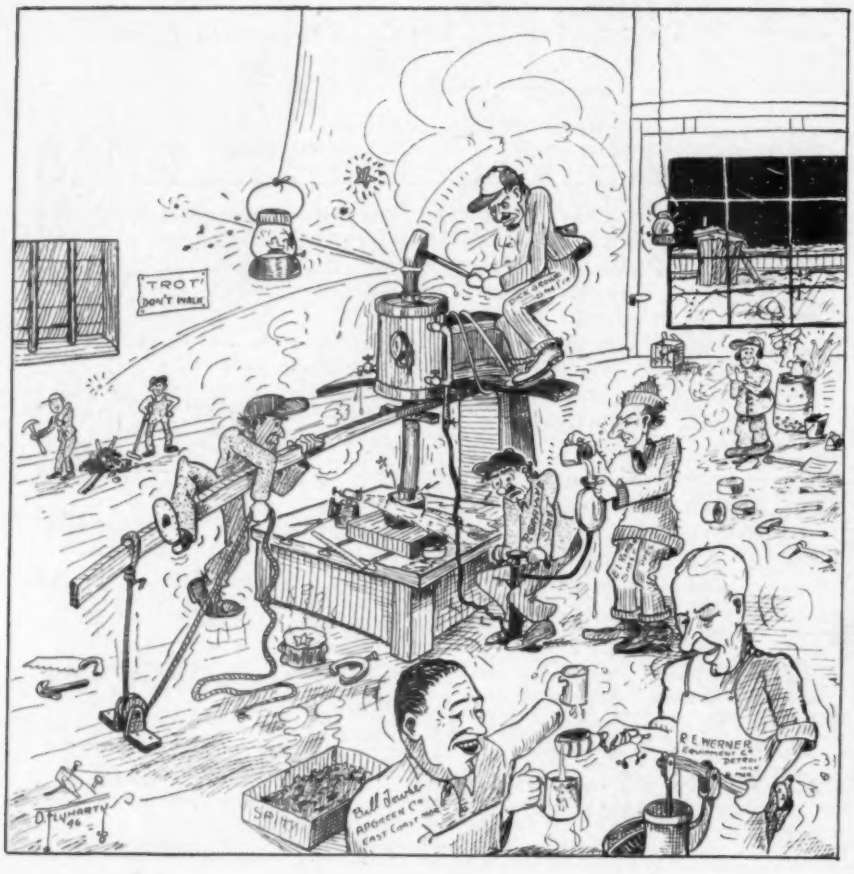
This piece, with a pipe nipple, is suitable for hydrostatic testing of stainless-steel seam welds

Thus, a typical seam welder of 18-in. throat depth and rated 100 kva., has an output current of 31,000 amp. at a maximum voltage of 5 volts. It is equipped with a series-parallel regulator to obtain secondary voltages of 5 volts and 2.5 volts. The kva. rating with the winding connected in series is in the ratio of 2.5 to 5 or 50 kva. A large transformer having both high kva. rating and high secondary voltage may not be able to supply a welding load as satisfactorily as a transformer designed with the necessary secondary voltage and smaller kva. rating.

The size and shape of the weld nugget can be determined by cutting a sample across the weld or through the middle and along the weld. After polish and etch, the overlap of spot welds is evident and should be approximately 20% of nugget diameter. Penetration of the fused zone should range between 35 and 70% of thickness. The width of weld depends primarily on the electrode face width and should range from 1½ to 3 times stock thickness. If the weld width is too narrow, penetration will be inadequate and physical strength lowered. If the weld width is too wide and penetration excessive, the weld center will be overheated and cause excessive warpage, buckling, and poor appearance.

A reliable physical test is the hydrostatic type in which two sheets of convenient size, 6 × 6 in. or 6-in. diam., one of which has a pipe nipple gas-welded to it, are seam-welded completely around the edges, then subjected to hydrostatic pressure until failure takes place. Failure will usually occur on an inside edge of the seam where the buckling, as a result of expansion of the test sample or "pillow," is greatest, provided the weld is pressure tight.

OUR SHOP...14 — Precision Hydraulic Hobbing



TIPS for Top Shop Men

137 The time is past when every shop was a stage for feats of strength and daring. It's your job to see that nobody tries or is asked to try a load that's too heavy or a job that's dangerous. You're responsible for our most critical "material"—manpower. Don't waste it in torn ligaments, strained muscles or hospital cases. The momentary thrill isn't worth the effort, let alone the trouble.

138 Remember the Golden Rule, "Do unto others as you would have them do unto you." Elbert Hubbard added, "but do it first!" Someone recently paraphrased it this way, "There's too much *get* and not enough *give* in business." If you ever went to Sunday School, you can figure this one out for yourself.

139 You can be a foreman without advice, but most of us need the advice and suggestions of others to be *good foremen.* Fewer headaches, more pleasure and less trouble can be the result of profiting by others' experience.

Practical Palletizing Pays Off

BY BERT R. LOEPER, Traffic Manager, and JOHN R. HUGHES, Package Design
THE ELECTRIC STORAGE BATTERY COMPANY

Palletized shipping will save time and money if each shipment is analyzed and savings weighed against freight and added costs

IN THE WORK of handling materials, muscle power is no more efficient or productive today than it was when the pyramids were built. Egyptian engineers had a good excuse for using it, as effective handling machines had not then been perfected. Besides, slaves were plentiful.

Such excuses are no longer valid. A wide variety of highly efficient handling machinery is now available, together with quick, safe handling methods. Use of manual labor to handle materials through any industrial process in volumes and speeds equal to the capacity of modern production machinery is not only wholly inadequate, but so costly that it represents a major obstacle to the profitable operation of almost every type of industrial enterprise.

War Emphasizes Material Flow

Two wars have dramatically emphasized the importance of mechanizing the over-all flow of materials through manufacture and product distribution. During World War I, unit load handling (lifting and shifting more pieces or pounds in a single handling operation) was developed to speed the movement of materials through mass-production operations by means of skid platforms and battery-powered, self-loading industrial trucks.

During the recent war, there was not enough manpower, either military or civilian, to handle the staggering tonnages of military supplies through a long series of loading, unloading, piling and unpiling operations all the way from production lines to combat zones. To relieve this critical shortage of manpower, military service and supply organizations took over from industry the time-saving methods of handling materials on pallets with fork trucks.

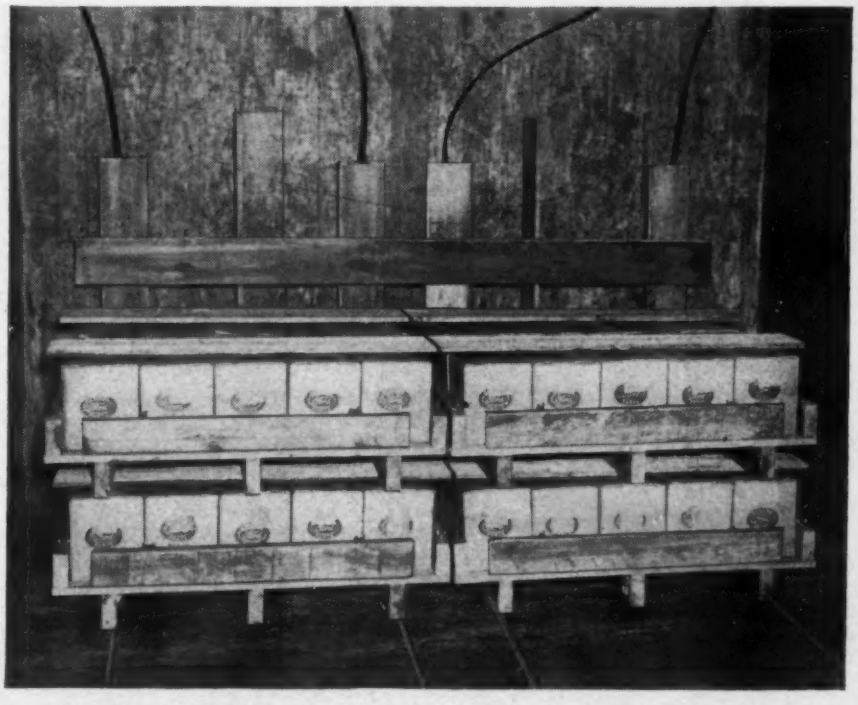
The success of these pallet-handling methods is indicated from a U. S. Navy report which disclosed that a manually handled carload of loose cargo required 682 manhours to load, unload and store along the supply lines from the contractor's shipping platforms to battle areas, whereas a palletized carload required only 203 manhours. Palletization reduced loading and unloading time as much as 85% and, in a few spectacular instances, even more such as cutting unloading time from 56 to only 2 manhours.

In the light of such wartime experience, it is natural that many manufacturing companies would like to use such time-saving methods in peacetime operations. But the big question, which in each shipping problem must be individually answered, is: "Will palletization and palletized shipments save money, as well as time?" Today, management must look first at *dollar* savings in over-all production and shipping costs of manufactured commodities.

Savings vs. Costs

Undoubtedly, palletized shipments can result in large savings of loading and unloading time. But these savings must be weighed against added freight costs, the cost of returning pallets and the cost of handling and servicing them.

Whenever pallets must be "deadheaded" to or from a destination point, the added cost of shipping and returning pallets may outweigh the other advantages of palletization. The word "may" is used because in a large number of instances the savings made in handling will far offset



Battery pallets, 40x48 in., have adjustable sides for securing packaged batteries. Stacked three high, two across and in four rows, pallets are braced in freight cars by steel straps running from back gate shown to the front gate

the added cost of shipping on pallets and return freight charges.

The conditions of each shipment differ with regards to the commodity shipped and distance of movement. Each operation should be evaluated on its own merits.

An average carload of merchandise will consist of from 32 to 48 unit loads with 4 rows in each end of the car, depending on whether loads are tiered two or three in height. This means the weight of 32 or 48 pallets is added to the freight bill *at the commodity rate*. So if the commodity rate comes to $0.01 per lb., the added cost would be from $25.60 to $38.40 with an 80-lb. pallet.

If the pallets are to be returned, the return freight at "pallet" rate adds more cost. For example, shipping pallets from Chicago to Philadelphia would cost $.392 each in carload lots and $1.00 each in less-than-carload lots (LCL). These costs sometimes overbalance any savings made in loading and unloading time.

Dividends from Turn-Arounds

Shipping on pallets can be done most economically when a "turn-around" movement is developed. Exide, for instance, has a large movement of battery plates from Philadelphia to Chicago and a return movement of lead scrap from Chicago to Philadelphia. Plates are shipped in specially designed pallet boxes, each of which replaces ten small plate boxes formerly used and has a capacity of 4,000 lb.

Plates are received and stored in pallet boxes at Chicago until used. The boxes are then reloaded with scrap and returned to Philadelphia. The pallet boxes move to Chicago under the battery-plate rate, and are returned under the scrap-lead rate. In this instance, pallet freight costs are greatly offset by savings in handling time which amounts to 16½ manhours per car on battery plates and reduction of from 60 to 70% in scrap-loading time.

A combination of outbound and inbound movements, or vice versa, with a short deadhead pallet move intervening, can also be worked out to advantage. When a manufacturer is shipping from his plant to a destination located a short distance from one of his sources of supply, in most cases it will be profitable to deadhead empty pallets from his destination to the supplier who then loads them with his product and ships them back to their originating point.

Although the economies to be gained in shipping on pallets have been successfully demonstrated in many peacetime operations, full and logical development of palletized shipments will result if the following are made fully available to shippers:

1. Reduction in pallet freight rates.
2. Light-weight prefabricated pallets.
3. Low-cost expendable pallets.
4. Pallet pools.

Rail, motor and water carriers have not, as yet, recognized the full advantage in handling palletized shipments. When and if carriers realize that this method of shipment enables a greater utilization of equipment and that damage claims will be greatly reduced, there is no doubt but that equitable rates on pallets will be established nationally.

Light-Weight Pallets

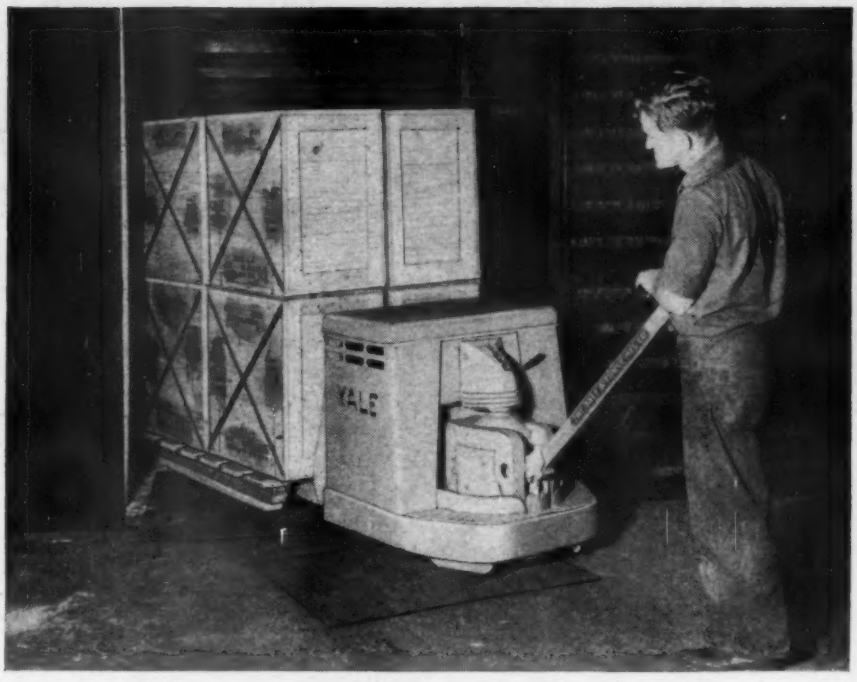
The development of light-weight pallets has introduced a new note in palletized shipping. Aluminum pallets, for example, weigh approximately 1/3 as much as wood pallets and make practical the shipping of unit loads of light-weight goods that have a high freight rate. A 40x48-in. aluminum pallet weighs approximately 36 lb., as compared to 80 lb. for a wood pallet of the same size. The 44-lb. freight saving per pallet on both outbound and return shipments results in an appreciable reduction in freight cost.

But only the conditions under which each shipment is made can show whether the use of aluminum pallets is economical. Their current cost of approximately $26, as compared to $3.50 for a wood pallet, can be quickly offset in cases where the commodity rate is high and pallets are returned in carload lots.

Low-cost expendable pallets also have their place in palletized shipping, especially for light-weight, bulky loads such as light bulbs, tea and tissue paper. Built up of impregnated paper, such pallets cost only 50 cents and weigh up to 15 lb. Their load-carrying capacity is relatively low as compared to wood or metal pallets.

Pallet pools, the most commonly suggested solution to the problem of return, have merit, but also definite limitations. Small, local pools are now in existence. Formation of a large pallet pool requires considerable organization to carry on the operation. Records must be kept of pallets shipped and received by each participating company, and pallets must be serviced, accumulated and redistributed.

Pallet boxes of 4,000-lb. capacity carry lead plates from Philadelphia to Chicago and lead scrap on return, to make ideal turn-around movement. Four straps prevent any sway or lengthwise shift



Batteries packed for export are loaded on single-faced pallets to permit one-man car loading by motorized hand truck

This last point is one of the major limitations of pools, because pallets will congregate at "slow" spots. It is at these spots where handling and redistribution may become a costly factor. If the flow of pallets, however, can be smoothed to eliminate slow spots, then pooling becomes practical.

Another suggested solution for the redistribution of pallets is the stocking and leasing of pallets by jobbers. The pallets would then be considered interchangeable between jobbers and companies in various localities. This plan also would require a central organization to act as a clearing house, as otherwise it would be difficult to make workable.

Before pallet pools can be made to operate efficiently, not only must clearing house procedure be established, but pallets must be standardized. In the past, many sizes of pallets have been developed to solve specific handling problems, among them being 32x48, 36x48, 35x45½, 40x48, 48x48, 42x66 and 48x66 in. As operation of a pool with so many different sized pallets would be impossible, a standard-size pallet, or at the most two, must be selected that will handle the majority of items shipped.

The Navy has standardized on the 48x48-in. pallet and has found it adaptable to an extremely wide variety of products by simply varying the unit load pattern on the pallet according to package size. For shipping batteries, Exide has found that a 40x48-in. pallet affords greatest flexibility in that it permits loading two across a freight car, the 48-in. way, and two across a truck, the 40-in. way. Pallets 48x48 in. are not nearly so adaptable to truck shipping, as a closed-truck body will not receive two, side by side.

The latest development in pooling is announcement by the Lawrence Warehouse Co. of a nation-wide exchange service, based on single-size, 40x48 in., four-way wood pallets.

Other conditions, also delaying wider adoption of palletized shipping, are non-standardization of handling equipment, lack of pallet-handling equipment in many plants, and low floor capacities that in some plants prohibit storage or moving of unit loads. These are minor factors which can and will be quickly solved once the major obstacles to profitable palletized shipments are removed.

And removed they shall be. Agitation for freight-rate reduction on pallets is making all segments of industry increasingly conscious of the time-and-cost-saving advantages of palletized shipping. This in turn will foster more demands for removal of the high "pallet rate" barrier.

Development in pallet materials and design is progressing rapidly. Sound experience is now being gained in pool operation. The final solution to the problems raised by palletized shipping will probably be a combination of those suggested. Palletized shipping will then evolve into an economical and practical method for lowering the costs of distributing materials.

The Inside Dope

FULLY TO COMPLETE their research on the behavior and action of lubricating oil in bearings, engineers of the Westinghouse Electric Corporation have called upon plastics. Transparent plastic models of machine bearings have been machined from solid blocks to close tolerances and set up to give "inside information" on lubricant action.

Now the engineers can see what is happening and can design bearings which will handle a heavier load and help make possible more powerful motors without any increase in size or weight of the unit concerned.

Oil, colored with a red pigment, is fed into the bearing model. Observation discloses just how the seals work, whether the oil passages allow proper lubricant flow and whether the relief points are located correctly. This formerly was determined largely by trial and error.

During tests, the rotating element of the model is operated by a hand crank for slow speeds and is motor-driven for high speeds. Redesign of the bearing follows the tests until the optimum lubricating efficiency is obtained over the length of the bearing.

Plastic model helps testing

ROUND TABLE

Why Help the Drummer?

"I hear you got pretty short and sharp with that tool salesman who came in the other day, Ed. What's the matter? Don't you need tools in the toolroom anymore?"

"We need tools all right, Al, but they should be bought without busting in on the working day. That drummer wanted to set up his display and have the boys gather around. That's a good lunch-hour idea, but wastes time otherwise."

"You sound like the kind of tools a man has don't make much difference. Here's a guy with a good brand of tools, saving the boys hunting on Saturday afternoon, and knowing what tool is best for each job. But you treat him like a racketeer."

"Well, isn't he one? He wants everybody to drop what he's doing and come around to get sold something he may not need."

"No, Ed, I don't think he is a racketeer. He knows what he's selling, from the ground up, and he's selling for a good outfit. He told me and some of my boys some tricks we didn't know about. And it didn't cost us anything either, unless we wanted to buy. In traveling around from plant to plant, that guy picks up plenty of feedbox dope. Just because he's selling something, you don't have to buy it, you know. Or are you afraid he'll talk you into getting some good tools?"

"My tools are plenty good, Al—they'll last as long as I do. And I don't need to be sold some new and fancy ones by a medicine man. He puts on his act and then you've gotta buy something to pay him back. Ill get my lowdown for less dough."

"That I doubt, Ed. Every time you kick a good salesman out, you miss a chance to pump him for what's goinng on in other plants. And all you get in return is the satisfaction of being a tough guy."

"Listen! I give the bum's rush to every peddler. Let the purchasing department buy for the company and the boys buy their stuff on their own time. Then I haven't got any responsibility for their mistakes if they buy the wrong thing, and neither does the company."

"That's a funny hunk of responsibility to duck, when you take the responsibility for not letting the salesman see the men at the plant. You're probably costing them time they spend with punk tools and the company the money lost because a job is done wrong or done late."

"Any peddlers are just smooth operators out to make a fast buck. I can at least stop it during the working day."

"I can see you've got a fixed idea, Ed, but you're dead wrong. The old-timers pulled a lot of tricky stunts to sell tools. But that's been out for years. Now they have to know what they're selling—and lots more—to sell well—they're like rambling consulting engineers. Most of 'em are old shop men, too."

"Maybe they can tell a youngster like you something, Al, but I was working in a shop before most of 'em were born."

"Big Chief Nothing-New-Under-the-Sun, eh?"

***SHOULD SALESMEN** from legitimate companies, selling products which are used by men in plants, be allowed to sell during working hours? What has your experience been? What are your opinions? Others would like to know. Discussions of earlier subjects appear on later pages.*

★ A SPECIAL American Machinist RESEARCH REPORT ★

How to measure MACHINABILITY in the shop

BY DR. ING. GEORG SCHLESINGER, CONSULTING ENGINEER

Machinability has long been one subject of consuming interest in the shop, but no practical test for this factor has been available. Life-long tests of various methods of determining machinability and tool life are here summarized by an international authority. He offers a table of cutting speeds and a simple 1-element dynamometer. We present it here to encourage development of simplified methods

TWO TYPES of machinability tests are in practical use: (1) *Short tests,* based on resistance of the material to be machined by a standard tool, the sharpness of which is controlled before and after making the trial tests by a check test on calibrated material; (2) *life tests,* which use as a criterion the visible dulled condition of the tool edge after a certain time of cut with an adequate speed and chip area.

Short tests qualify the resistance of the workpiece material as a single unknown quantity against the penetration of any tool, measured by the cutting force. These tests characterize a *property of the material* only —its real machinability.

The result is similar to tensile, compression, impact, hardness, tests, etc., which use a standardized test body: ball (Brinell), cone, pyramid (Rockwell, Vickers), hammer (Shore), knife (Izod), etc., the keeping-up of which is beyond the scope of the operator. It identifies the property under test with a single figure, which we will call here "Machinability Index." If a short test is made with a cutting tool (for example, by drilling, turning, planing), the tool must retain its sharpness during the test.

On the contrary, life tests are based on the dulling property of a material by its resistance to, and/or abrasion of, the cutting edge of the tool. A single-point or a multiple-point tool may be used. In all life tests the reciprocal influence of two variables is measured simultaneously: (a) of the material of piece on (b) the cutting edge of the tool, until this tool is measured as dull.

It is obvious that reliable short tests are preferable for determining machinability of materials, hence almost amazing that most tests made in the last 50 years are of the life variety. The explanation may be that results of correct life tests are directly applicable in the shop. They reveal working conditions for the investigated material, including speed, feed, depth of cut, material and shape of tool used. Their disadvantages are that they need considerable time, much material, a trained laboratory staff and fairly complicated apparatus, and are limited both in the type of tool used and the material machined.

If one working condition is changed, the lengthy and expensive life tests must be repeated. Short machinability tests, however, providing an index number for the material of the test piece, can be adapted to all types of tools, require little time, negligible quantities of material, and can be done in the ordinary shop on ordinary machine tools, requiring only standardized identical cutting tools, if the measuring apparatus is correctly designed.

In tests to evaluate either material

of piece (index) or quality (life) of tool, there should be but one variable: either the material or the tool. All other factors must be kept constant; otherwise an unequivocal determination of the desired variable is impossible.

A short review will show development of both short and life tests with the available present practical and simple apparatus.

Machinability should be defined as the resistance of a material, if adequately machined, measured by the main cutting force (F) in pounds.

Tool Life is the time between grinds, if a tool of a certain shape and material is used to machine a certain workpiece material at known speed and a standard chip cross-section. Here the connection between time (t) and speed (v) is generally given by the equation: $v \times t^n = C$ (Fig. 1), where v = cutting speed in fpm., t = tool life in minutes between grinds, $n = \tan \theta$ (the slope of a straight line in the log-log system, determined by v and t); and C a constant depending on the standardized working conditions, which equals the (very high) cutting speed for a tool life of 1 min. The dulling time t depends on the chosen speed, v, which was selected by F. W. Taylor in 1900 on the basis of 20 min. and is today between 60 min. as a minimum and $8 \times 50 = 400$ min. (tool life of an 8-hr. shift).

For both short and life tests standardized working conditions concern:

(1) tool material and hardness,
(2) tool shape,
(3) cutting-edge sharpness,
(4) cross-sectional area of chip and ratio of depth to feed,
(5) coolant,
(6) machine tool or another adequate testing apparatus,
(7) quality of the surface produced.

Surface quality is irrelevant in roughing tests, to which this discussion is restricted. But the first six items mentioned involve 19 variables (as described under "Turning Tests"; the shape of the single-point cutting tool on lathe or planer involves eight alone. This explains why this problem is so difficult and has required about 45 years of hard work of many research men in Great Britain, the United States and on the Continent to obtain simple and practical solutions.

Steps in the development of short tests for machinability include the drilling, the pendulum and the turning tests.

Short Tests by Drilling

The Americans Keep and Loren designed a simple drill tester as early as 1897. This was developed later (1901) into a real machine tool (Fig. 3), using as a criterion of machinability the vertical feed thrust produced by a known weight (pounds) at a constant lever arm. Feed thrust and cutting speed were adaptable to the materials. Drill diameters were standardized to ⅜ and 3/16 in. The tests were used especially to investigate the machinability of castings. The 3/16-in. drills were used to test thin-walled bushings to replace the Brinell hardness test, which is unsatisfactory for investigation of casting machinability.

Diagrams produced by the tester (Fig. 2) plotted the number of revolutions of the drill (ordinates) against the depth of the hole under a constant known feed thrust (weight); graphs were drawn automatically on the drum in a few minutes and required very little test material.

First, a check test was made on a piece of cast iron of standard machinability, the reference figures being based on 100 rpm. The graph drawn was a straight line (N_1) of a certain inclination. Then the new casting or test bar was drilled with the same drill under the same working conditions. The graphs (G_1, G_2, G_3, G_4, etc., Fig. 3) gave lines generally under an inclination deviating from graph N_1. Harder material gave less depth (a steeper graph) and vice versa. A straight line proved that structure was uniform; a hole about twice drill diameter deep was sufficient, because the material removed from castings is seldom more than ½ in. (scale was removed before drilling).

To measure sharpness of the tool is one of the most difficult shop problems. At the end of the series of tests, graph N_x *was* drawn with the same drill again on the calibration piece; if the inclination of line N_x was the same as that of N_1, it proved the drill had kept its size and sharpness. Because tests 1 to 10 between graphs N_1 and N_x were made with the same drill, the influences of diameter and sharpness were eliminated.

These drill tests could be extended to find the machinability of steels and non-ferrous materials. The difficulty was to keep cutting-lip shape and drill cross-section identical, otherwise working conditions were changed and results were not comparable. Therefore, the ordinary commercial twist drill could not be used, because the web (the central column of metal, Fig. 4) generally increases in thickness towards the shank (however, there are twist drills with cylindrical web).

Thickening of the web as it nears the shank naturally decreases the area of the flutes. To offset web thickening, the flutes widen as they approach the shank. Thus, with every grinding, the commercial twist drill changed shape, so was replaced by a straight-fluted drill which keeps its shape precisely from beginning to the end, guaranteeing the reproduci-

Fig. 1—O. W. Boston's 1944 proposal to the ASA to standardize tool life was based on this diagram

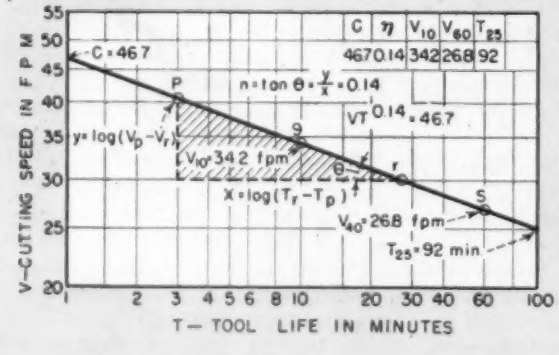
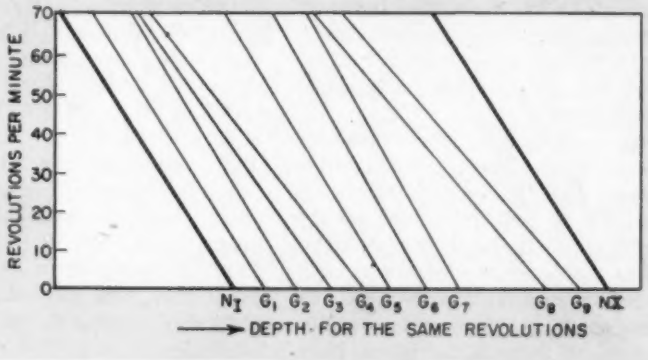

V—CUTTING SPEED IN F P M
T— TOOL LIFE IN MINUTES
C = 467
C | η | V10 | V60 | T25
467 0.14 342 268 92
n = tan θ = y/x = 0.14
VT 0.14 = 467
y = log(Vp − V1)
V10 = 342 fpm
X = log(T1 − Tp)
V60 = 268 fpm
T25 = 92 min
P
Q
R
S

Fig. 2—Thrust diagrams according to Keep, produced by the drill tester sketched in Fig. 3 (upper right)



bility of tests. Such a drill (Fig. 5) was applied by Keep[20] and gave a correct solution. The drill was made of a very uniform high-speed steel, ground and checked by gage. Such a straight-fluted drill makes it possible to grind the same front cutting angle (α) from the external diameter to the center, and also to grind a constant relief (β).

Dalcher Tester

A drilling machine of quite different design, but using thrust and torque combined as a measuring criterion, is the Dalcher Tester (Figs. 6 & 7)[43]. The spindle has an automatic feed and carries a head for measuring spindle thrusts. The measuring head (Fig. 7) consists essentially of two telescoping bodies held apart by an accurately calibrated spring. The upper body is secured to the end of the drill spindle, while the lower body carries a chuck which holds the standard test drill.

Index grooves turned in the chromium-plated outer surface of the lower body provide a means for measuring the amount the spring is compressed during a given test run. To obtain accurate readings while the spindle and test head are revolving, an optical unit (Fig. 6) is secured to the drillpress table. Light from the lamp is directed by condenser lenses onto the index sleeve. Reflected light rays are directed onto a screen through an intermediate lens. An enlarged image of the index grooves appears on the screen as stationary lines easily observed while the machine is in operation. Each test piece first is provided with a small, standard-diameter pilot hole. This eliminates errors resulting from the dead-point pressure (important part of vertical thrust) on the test drill and makes certain the cutting action of the drill lips will be measured in test readings.

After the pilot drill has been removed, a standard ⅜-in. dia. test drill is inserted and the drillpress set for proper speed and feed for the material to be tested.

As the test drill enters the material, the calibrated spring is compressed an amount equal to the pressure required. Calibration curves are maintained for each test spring. These interchangeable springs are checked at frequent intervals to insure accuracy of test results.

Dalcher replaces the constant weight of Keep by calibrated springs. But this is no advantage, nor is the optical apparatus simpler or more reliable than Keep's simple pen records, based on counting the

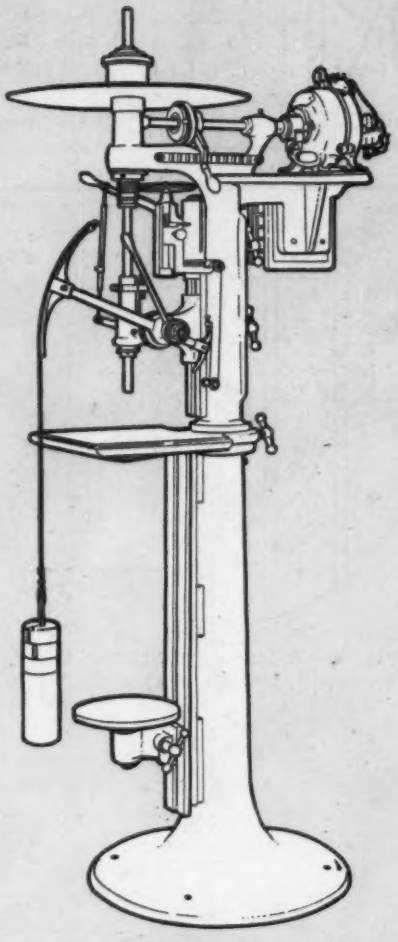


Fig. 3—The Keep-Loren drill tester, designed in 1901, is still a modern design

Fig. 4—Most commercial twist drills have tapered webs

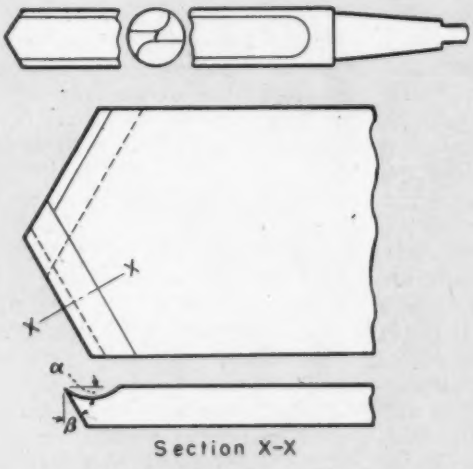


Fig. 5—A straight-fluted flat drill for testing

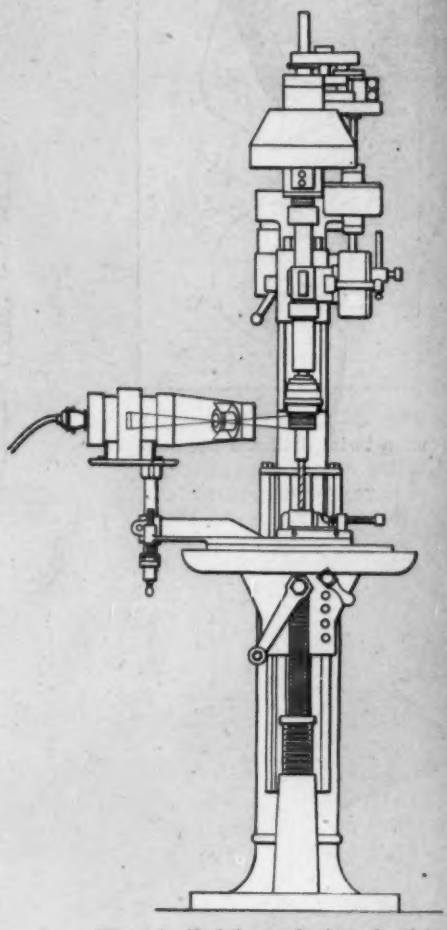


Fig. 6—Dalcher designed this drill-testing machine in 1939. Thrust is measured by reflecting a projected beam of light from grooves to a screen

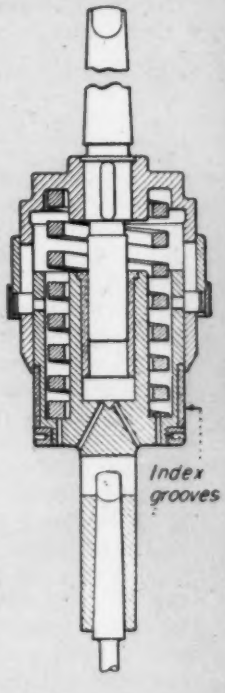


Fig. 7—Dalcher developed a spring-loaded drilling head

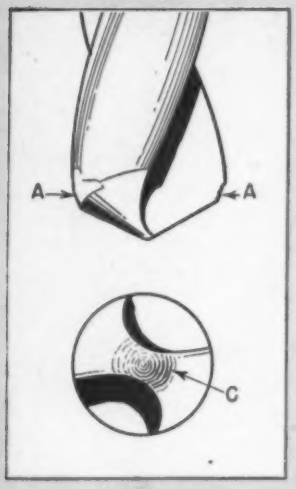


Fig. 8—External edges *A* of a twist drill are the sensitive areas. A worn chisel edge is shown at *C*

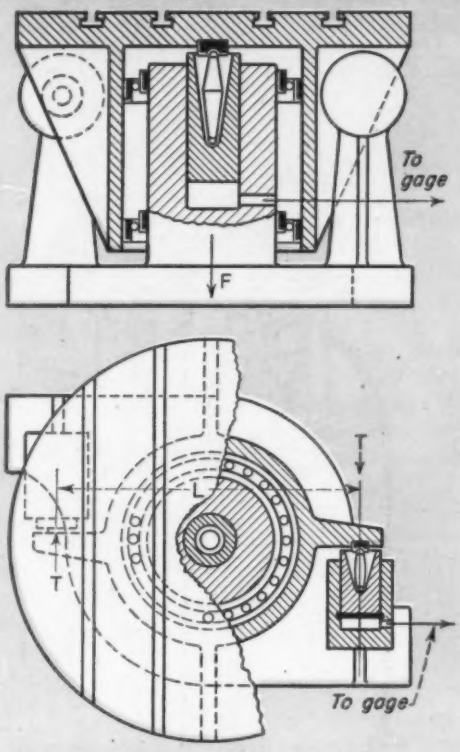


Fig. 10—A torque and thrust table developed by the author in 1912

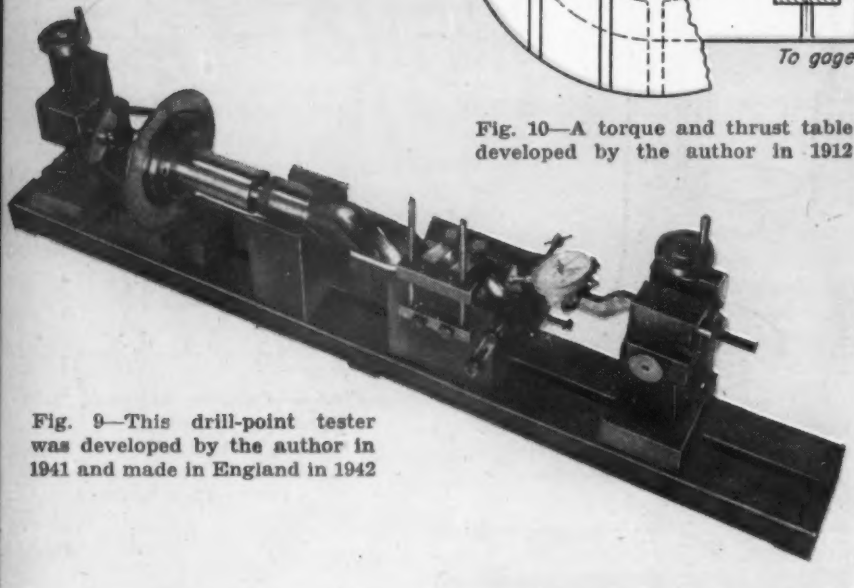


Fig. 9—This drill-point tester was developed by the author in 1941 and made in England in 1942

drill revolutions during the run.

Both the Keep-Loren and the Dalcher tests are real machinability short tests based on the resistance of materials against the penetration of a drill, working under adequate but identical standardized cutting conditions controlling the sharpness of the drill, with or without coolant, and comparing the results on a new material with the known properties of a standard material as check test.

Surely, drill testing is superior to the Brinell test because it is a real machinability test; but it is not commonly used. The principal objection to it is that it is very difficult to secure identical drill points and that the correctly shaped but rotating tool is influenced by errors of the drill spindle.

Keep used combined thrust on the cutting lips and the dead center of a flat drill as his criterion; Dalcher eliminated dead-center thrust by predrilling a small central hole; but there is little difference in the fundamental methods to determine the machinability of material by sharp drilling.

Because the twist drill is one of the commonest tools in all plants, handled commonly by unskilled labor, a good many investigators tried to use tool life of the twist drill as a criterion of the machinability of materials by drilling. An unusually thorough and careful volume of research (biblio., 1 to 15) has been completed with dependable results, so we have all necessary shop data on correct application of twist drills on ferrous and non-ferrous materials. The commercial twist drill is a finished tool, completely hardened and unalterable in its basic shape: diameter, flutes, margin, body clearance, web, shank and hardness. Only the point, consisting of cutting lips, lip clearance and dead center, can be adapted by grinding to suit different materials.

Tool life of the twist drill depends upon the sharpness of the external edges of the cutting lips (*A*, Fig. 8) as the most sensitive points, not on the dead center or chisel edge, which may be dulled by the first three holes yet does not prevent the drilling of a hundred holes more, as long as the outer edges *AA* remain sharp. This is one explanation why the thrust test (Keep-Dalcher) cannot be used for life tests of drills.

Condition of the cutting edges may be checked by drill-point testers (Fig. 9), which permit measurement of the ground surfaces of the relieved cutting edges, with relation to the ground cylindrical part of the drill and adjustment to locate the axis of the drill from the center of the tapered shank. I had this instrument designed in 1941 for the research department of Production Engineers (England); it was made by the small-tools department of the Atlas Works, Thomas Firth and John Brown-Sheffield.

The effect of correctly relieved cutting lips was proved when the shape of point was changed from that supplied by the drill maker to that of the research department, increasing the life from 70 to 280 holes and the total depth drilled from 9 to 36 ft. The best characteristic for a drill-life test is plotting the total depth in feet drilled between grinds (as ordinate) to the cutting speed in fpm. (as abscissa). The simplest measuring instruments are those using hydraulic gages with diaphragms for the torque, but without diaphragms for the thrust (Fig. 10). With these instruments, all data developed for thrust, torque, speed

TABLE I

Effect of Various Soluble Cutting Oils on Drill Performance

CUTTING FLUID	DILUTION	DRILL LIFE (Holes Drilled
Oil 1	1:15	144
Oil 1	1:25	130
Oil 2	1:25	65
Oil 2	1:35	64
Oil 3	1:15	14
Oil 3	1:25	4
Dry	.....	4

Data: Drill diameter ⅝ in. Speed = 760 rpm. = 124 fpm.
Feed = 0.014 in. per rev. = 10.6 in. per min
Depth = 1½ in. (blind hole)
Drill material = Substitute S.H.S. Material drilled = Steel 0.25 % C., 0.65 % Mn, normalized. 135 Brinell. Rate of coolant flow = 3 gpm.

and feed and tip angles for different materials were found suitable for shop use and indispensable for the designer of drilling machines.

Yet the drill life test was not accepted in practice for determining machinability of materials, in spite of 40 years of extensive and successful research work. This may be explained by objections to the tool and to the drilling machine.

Tool Shape Complicated

Tool—The shape of the twist drill is complicated; cutting effects depend particularly upon correct grinding of the point, which must be symmetrical and concentric and have correct relief over the whole cutting edge. Relief changes considerably from the external diameter to the center, increasing with the decreasing diameter. Reliable drill points can be ground only by a careful operator on well-designed and well-maintained special twist-drill grinding machines. Further:

1. The spindle of the drilling machine must run true.
2. The point of the drill must run true when the drill is inserted in the spindle.

Conditions are quite different from those in the turning tests, where the tool is stationary and the piece is rotating between correct centers, running true after the first skimming cut.

The tapered shank of the drill must have the same axis as its fluted portion, and internal taper of the spindle must be concentric with both the axis of the spindle and the external taper of the drill. If life tests by drilling to determine the machinability of materials are to be of any value, all mentioned possible errors must be eliminated. Therefore, it is necessary to have:

1. A drilling machine, the spindle of which is running true according to the acceptance-test charts of drilling machines.
2. A spindle which remains perpendicular under greatest stress.
3. A correctly ground drill, which must be checked before use for:
   a. Concentricity of the drill point to the cylindrical part of the drill.
   b. Symmetrical position of the two cutting edges.
   c. Correct relief.
   d. Correct inclination of the helix to remove chips without jamming.

With all these requirements, it is difficult to make reproducible drilling tests, even in the same well-equipped laboratory. Comparison of such tests from several research departments proved still more difficult. The condition that the drill in the spindle must remain perpendicular to the drilled plane surface caused me to use a double-strength drilling machine as early as 1924.

In close collaboration with Adcock & Shipley (Leicester, England), a special machine (Fig. 11) was made in 1941 and equipped with practically the instruments used in 1924 for torque and thrust (cf. Fig. 10). Such a heavy and reliable machine is very useful for periodical tests, for instance to distinguish the cooling properties of various cutting oils, when all variables are standardized but the coolant.

Table I shows tests with three different coolants, with the dry test as basis. Cutting speed and feed were chosen so the high-speed-steel drill was dull after the fourth hole. Oil 1 of dilution 1:15 increased tool life to 144 holes and demonstrates the influence of the correct coolant on the increase of output: $\frac{144}{4} = \frac{36}{1}$.

Still more disturbing is the fact that chip removal from the drill point upwards against the direction of feed becomes more difficult the deeper the drill penetrates. Then clogging of the chips of soft materials (for example, mild steel of 30 tons/sq.in. tensile) which are easily machined by turning, planing or milling, destroys the cylindrical part of the cutting lips (Fig. 12) and creates the impression that the soft material is more difficult to machine than the hard one. (*next page please*)

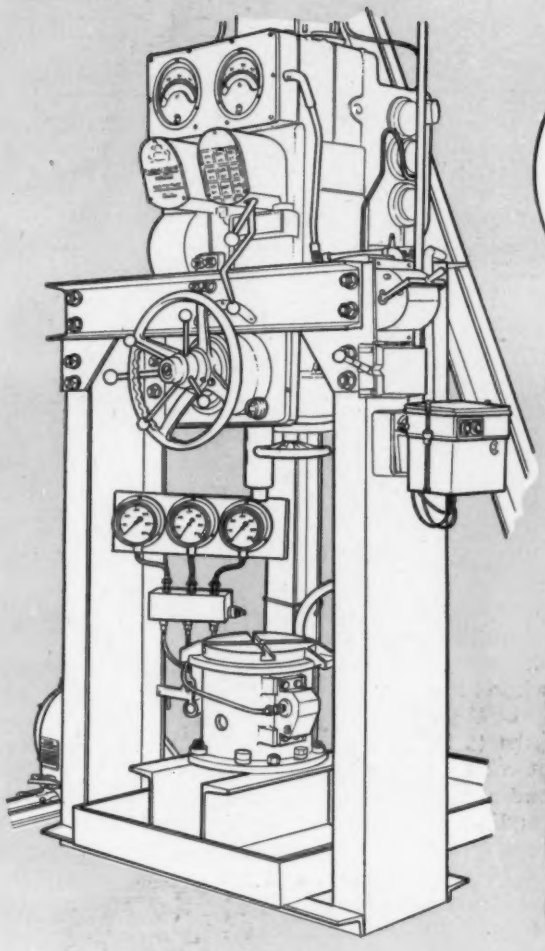


Fig. 11—Designed by the author in 1939-40, this heavy drillpress has a 15-hp. motor, speeds of 16 to 1500 rpm., can take a 2-in. dia. drill. It has a hydraulic measuring table

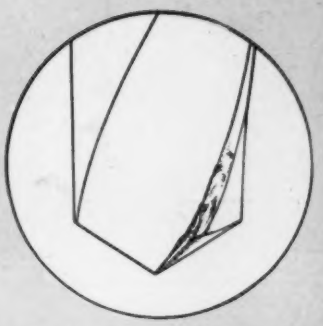


Fig. 12—"Smearing" or galding of soft steel being drilled destroyed ⅝ in. of the cylindrical margin of this drill

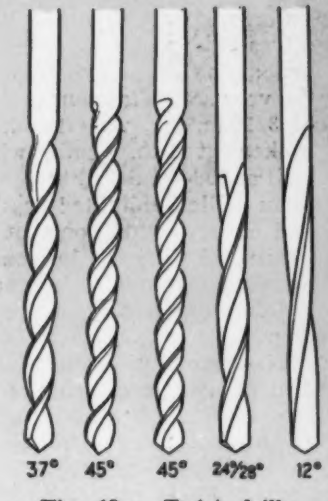


Fig. 13a — Twist drills of five different helices

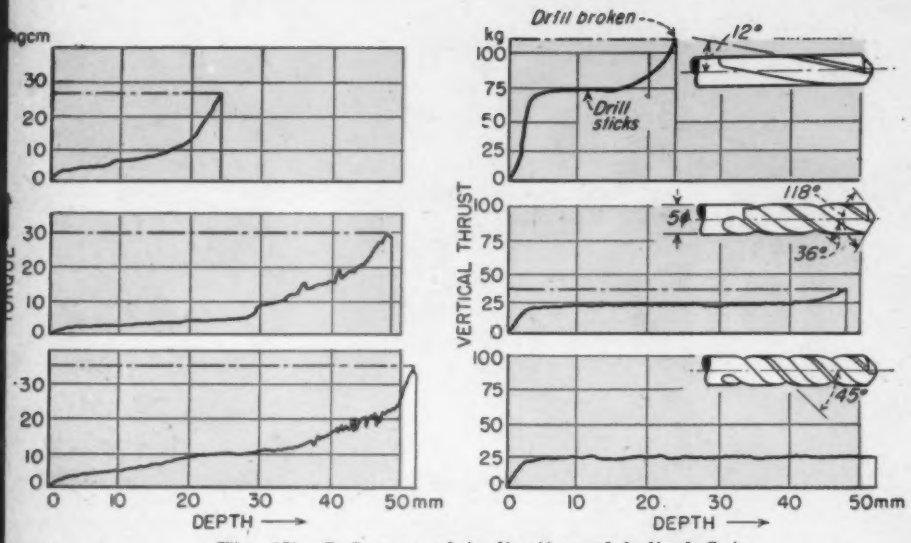


Fig. 13b—Influence of inclination of helical flute to torque thrust for three angles, 12, 36 and 45°

Correct inclination of the flute solves this problem.

Fig. 13b shows that in drilling the very soft "Electron," a twist drill of 3/16-in. dia. with 12° helix was broken at 1-in. depth, whereas a drill of 36°—and still better of 45°—helix drilled unlimited depths (2 in. and more) with constant vertical thrust (25 kg. = 55 lb.) and slowly increasing torque corresponding to the growing dulling of the external edge.

The necessity of adapting inclination of helix and shape of point to the various materials requires the ordering and use of different drills in the same shop (Fig. 13a) and accordingly careful organization. Because twist drills must be bought from outside, while lathe and planer tools can be made and ground to shape in the tool room, the drilling test for tool life or machinability has been abandoned, but the best drilling conditions were carefully investigated[9] to determine correct drills for maximum efficiency on all existing materials.

Short Tests With Pendulum

The Leyensetter double pendulum[16] is a mechanical device consisting of a horizontal bar *AF* (Fig. 14) hinged at *A* so it is free to rotate about *F* in a vertical plane. Normally, it rests in a horizontal position on a support *S*. From the outer end *A* of this horizontal bar is suspended a vertical pendulum bar *AT*, which is free to swing in a vertical plane about *A* and carries at its lower end *T* a toolholder. A delicate recording gage or indicator is attached to the horizontal bar near *A* so it can measure and record any small vertical movement of the horizontal bar.

The appliance is used essentially for testing sharpness of the edge of a cutting tool of suitable shape. The tool is placed in the toolholder of the pendulum, and a piece of suitable material *P* (for example, steel) is fixed in the clamps of the machine in such a way that the tool swung forward by the swing of the pendulum strikes the surface of the piece and cuts into it to a standard depth ($d = 0.6$ mm.), forming a short groove.

A tool of sharply triangular section is used. Provided it has a perfectly sharp edge, the cut is made without producing any upward movement of horizontal bar *A F;* i.e., the forces which come into play between the tool and the work, starting with a pendulum swing of only 15°, have no vertical component. If, however, the edge of the tool is worn by use, then an upward reaction occurs when the edge strikes the "work," and the horizontal bar is lifted to a degree which increases with tool bluntness.

To get this bluntness as parameter for machinability tests, Leyensetter makes an unexpected detour through a kind of short-life test. A triangular tool is first freshly ground, and its "sharpness" tested by putting it into the pendulum apparatus and verifying that it causes no lift of the horizontal arm when it takes the small cut of standard depth out of a piece of *standard* (calibrating) steel. The tool is then removed from the pendulum apparatus and placed in a special lathe toolholder designed to fit accurately into both the pendulum and the lathe, and the material under test is turned with the tool.

This operation must be conducted under carefully standardized conditions, a depth of cut of 0.2 mm. (0.008 in.) and a feed of 0.45 mm. (0.018 in.) and a travel of 25 mm. (1 in.).

Special care must be used to mount the tool in such a way that the "chip" runs over the edge in as nearly a symmetrical manner as possible. If this condition is not secured, wear on the tool is uneven, and the test is spoiled by the introduction of lateral components into the system of forces acting between tool and "work" in the pendulum apparatus. After completion of the turning test on the material under examination, the tool is replaced in the pendulum apparatus and tested. With even a slightly worn edge, an appreciable lift of the horizontal bar is produced, and its amount is regarded as a measure of the degree of blunting of the tool. This, in turn, is considered a measure of the resistance to machining of the material used for the turning test.

Some results obtained in testing the effect of increasing cutting speed

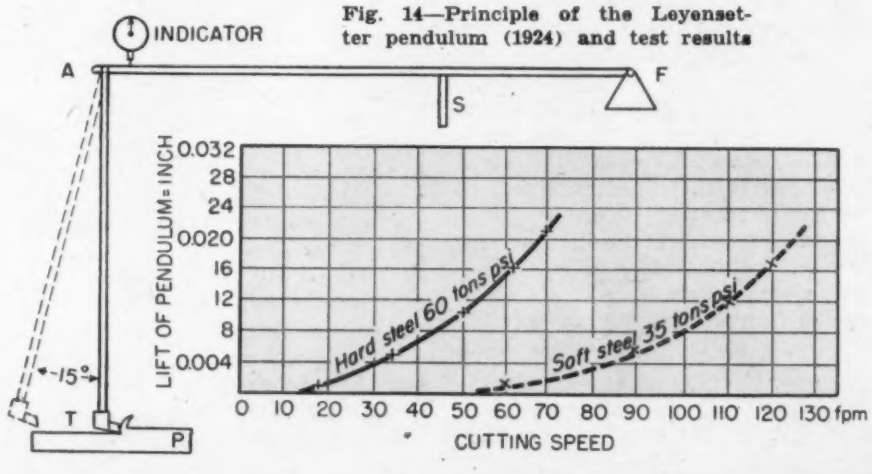


Fig. 14—Principle of the Leyensetter pendulum (1924) and test results

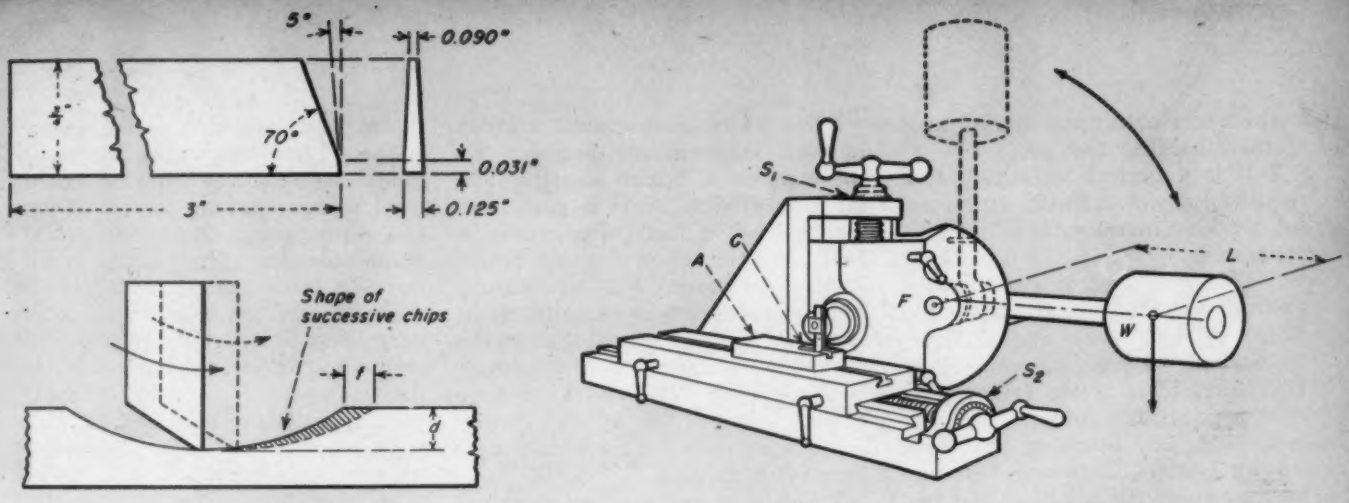


Fig. 15—The Oxford-Airey pendulum machine. Momentum equals WxL, with F as the fulcrum. Details show tool shape and type of chip

on two steels of widely differing physical properties are shown in Fig. 14, where the rise of the horizontal bar A F in thousandths of an inch is plotted against the cutting speed in feet per minute.

There are, however, a number of limitations which apply to tests of this type with the Leyensetter pendulum. For example, it was found that not every kind of cutting tool will give satisfactory indications in the pendulum. High-speed steels (18-4-1) cannot be used at all, it is suggested, because they do not wear by a loss of sharpness of the actual edge, but by formation of a groove behind the edge, where the chip impinges on the upper face of the tool. The steel preferred for making the tests is one of the type containing about 5% tungsten only. It is, however, necessary to remove any built-up edge from the tool before re-testing it in the pendulum. As the degree to which the edge is built up must depend upon the behavior of the material being machined, this requirement may tend to give a wrong impression of the true behavior of the material.

As a matter of fact, the Leyensetter test is a mixture between a short test of tool and an awkward machinability test of material. Serious objections can be made to both indications. The described cutting test is a short wear test; if there is no wear on a travel of 25 mm.—equal to 1 in. cutting action—there is no rise of the pendulum. Then we have learned only that this material did not blunt the tool in one minute. If it was blunted, we know the material was harder than the standard material.

I made long-life tests[16] on eight German (Krupp) and four American (Gary) nickel and chromium-nickel alloy steels for the motor-car industry for about a year to find a practical basis for standardization of these steels and their best working conditions, and found differences up to 50% between the Leyensetter classification and the incontestable life tests. These non-permissible differences were confirmed by the research department in Aix-la Chapelle (Wallichs-Krekelar)[13]. As far as I know, the Leyensetter criterion was not accepted by the industry.

Oxford-Airey Machine

Another application of the pendulum test is made by the Oxford-Airey Pendulum Machine[17] (Fig. 15). This machine, as used in the research department at Woolwich, England, since 1936, consists of a weighted pendulum W, the shaft of which carries on one side a pointer moving over a scale graduated in degrees, and on the other a cutting tool. The pendulum assembly can be moved both vertically and horizontally by hand with respect to the baseplate on which the test specimen is firmly clamped in order to give varying depths and feeds of cut.

Calibration of the machine is carried out in the following manner: The height to which the pendulum rises when allowed to fall freely from the position of maximum potential energy is taken as zero, and the height to which it rises after cutting the test piece gives a *measure of the energy absorbed in cutting.* This energy is said to be proportional to $(1-\cos\alpha)$, where α is the angle to which the pendulum swings after making a cut. From this angle and the weight of the pendulum a numerical value for the work done can be calculated.

In carrying out a test, the specimen A is firmly bolted to the baseplate of the machine and the cutting tool C lowered until it just clears the test piece. Then it is clamped and scales S_1 and S_2 are adjusted to zero. Clamps controlling vertical movement are then released and a cut taken by lowering the tool slightly and swinging the pendulum. This procedure is repeated until the desired depth of cut is obtained, as measured by the scale S_1 which is graduated in thousandths of an inch. Measurements of the hand feed (i.e., the horizontal movement) are made from scale S_2, graduated similarly. Clamps are tightened by hand when a cut is taken.

Fig. 15 shows the type of chip formed during testing. In each experiment, ten cuts are usually made at constant depth and feed, the energy absorbed being noted and the weight of metal removed being calculated by collecting and weighing the chips. From these values, the energy absorbed in removing 1 cu. in. of metal can be deduced. This value is used as a criterion of the relative machinability of the material under test.

The results obtained have shown that the energy consumption per unit volume of metal removed on any one material varies inversely as some power of the feed, inversely as some power of the depth of cut, and inversely as the top rake of the cutting tool at constant speed with any one coolant and tool material.

It is admitted that tool-wear and tool-life tests cannot be made and cutting speed cannot be varied systematically, but it pretended that a result has never been obtained contrary to that obtained in practice. It is, therefore, considered that the energy absorbed per unit volume of metal removed, as determined by the Oxford-Airey pendulum tester, does provide a useful indication of the machinability of the material undergoing test. (*next page, please*)

The main objections to this kind of machinability test are:

1. It is a typical laboratory test, requiring a well-trained, very careful, working investigator and special apparatus.

2. The tool used is similar to a parting tool, but the cutting edges (0.125 in. lengthwise and 0.031 in. downward) have no clearance. Therefore, their action is not free-cutting at all, but rubbing from the beginning, i.e., blunting the three cutting edges. Clearance, however, would change the width of the tool by regrinding and make the tests not comparable with each other.

3. Cutting speed, depending on the free fall of the pendulum weight W and its radius L from the fulcrum F, has its maximum value at its lowest point, just touching the test piece. It then decreases quickly because: (*a*) it rises against the opposing weight (*b*) the cross-section of chip increases considerably, (*c*) friction of the swinging axis is counteracting.

4. The chip has the comma-shape of the milling action, but the working conditions (very variable cutting speed, hand feed f and badly shaped tool) are unfavorable.

5. The cutter is working by impact; the cutting edges may be impaired by the first shock. Then the next nine cuts are done with an increased blunting of the edges.

6. The parameter is very "artificial" —energy at rest, divided by the maximum potential energy, as the basis for work done, converted into amount of metal removed in cu. in.

This parameter may compare fairly well with the results obtained by practical machining, if the instrument is used by a specialist[X].

X cf. Kenneford on his tests at the Armament Research Department at Woolwich

I had a chance to control a series of tests made in my presence by the chief of a British metallurgical laboratory with such a pendulum machine. Five tests were made in half an hour, observing all necessary precautions. But the results differed up to 50% in value taken on the same mild steel, writing down the angle as basic datum to which the pendulum swings after making a cut. Observation of the cutting edges after each cut confirmed their increasing blunting.

There will be some relation between even this unusual chipping action of the pendulum tool with the machinability of materials, which excludes any reliable reference to the measurement of tool wear and tool life. But the relation between Brinell hardness and machinability, stated the first time by Wallichs-Aachen and confirmed by me[35c] (Fig. 16) for alloy steels is much quicker and simpler to do. It is restricted to a certain class of steels, is not reliable and is no parameter for either machinability or tool life. However, it is well known that a great many well-organized shops use the Brinell hardness and/or the tensile strength of rolled materials to determine the cutting speed and cutting-tool material in modern planning and rate-fixing departments.

Turning Tests

The modern shop is longing for a machining test which can distinguish:

1. The machinability of ferrous and non-ferrous materials, rolled or cast, measured by resistance against a real cutting action as a property of a certain material.

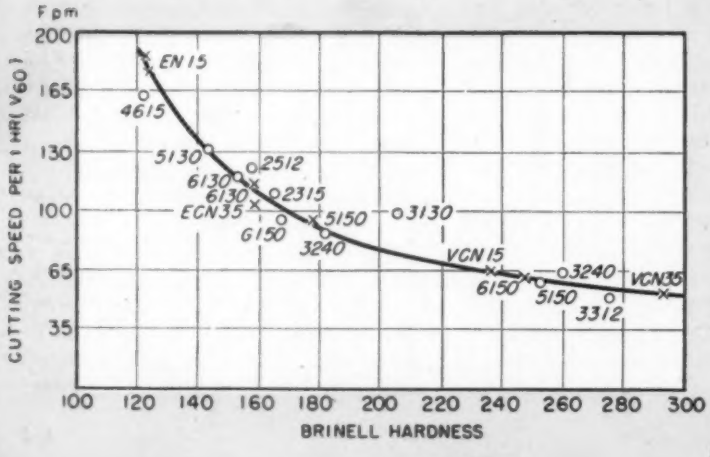
2. The tool life measured by cutting speed and endurance-time between grindings as a tool property.

The chosen machining test must guarantee identical working conditions from beginning to end of any test, reproducible all over the world. Preferable are simple shop conditions so machinability tests can be made or repeated daily in any ordinary shop or even in the materials storeroom on an ordinary lathe by the storekeeper, who may today operate a Brinell, Rockwell or Vickers tester for the same purpose. If tool-life tests could be added afterwards to determine the hourly speed (v_{60}) or the shift speed (v_{480}), the adequate tool material and the influence of a coolant, so much the better. But these two kinds of information — machinability and tool life—should be strictly separated; they have quite different purposes.

The most-used machining process is turning, which has been investigated since J. Thime's fundamental tests (Petersburg, 1877) in full detail. Researchers have determined for the same material of workpiece:

	Variables	
I. Tool:		
(1) Shape (7 angles, 1 nose radius),	8	
(2) material,	1	
(3) hardness,	1	
(4) sharpness	1	11
II. Cutting Conditions:		
(1) cutting speed,	1	
(2) cross-sectional area of chip (depth x feed),	1	
(3) ratio of depth to feed,	1	
(4) coolant (including dry)	1	4
III. Material of Piece:		
(1) cutting forces (3 components)	3	
(2) abrasive effect (Abrasion No.)	1	4
Total		19

Fig. 16. — Machinability and Brinell hardness of Ni and Cr-Ni alloy steels form a parabolic curve

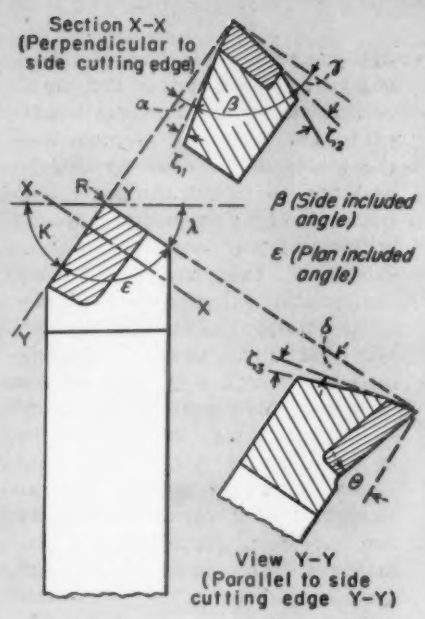


ALLOY STEELS GERMAN MARK	AMERICAN MARK S.A.E.	BRINELL NO. CHECK TESTS	MACHINABILITY BY CUTTING SPEED V_{60} = fpm
EN15		125	180
ECN35		155	102
VCN15		237	65
VCN35		292	50
(ECN35)*	2315	162 (155)*	105 (102)**
	2512	158	120
	3130	156	110
(VCN15)*	3240	254 (237)*	62 (65)**
(VCN35)*	3312	274 (292)*	50 (50)**
(EN15)*	4615	122 (125)*	165 (180)**
	5130	144	130
	5150	178	90
	6150	168	98

* The Illinois Steel Works selected alloy steels as equivalents to the German marks according to analysis and approximate Brinell hardness.

** Tool life proved that the corresponding machinability with v_{60} was very nearly the same for the German and American steels.

TABLE II—STANDARD SINGLE-POINT TOOL SHAPES FOR VARIOUS MATERIALS



Angles →	T	θ	α	δ	K	λ	δ	R	ζ_1-ζ_2-ζ_3
Class of Material to be machined	SIDE RAKE, °	BACK (TOP) RAKE, °	SIDE CLEARANCE, °	FRONT CLEARANCE, °	PLAN APPROACH, °	PLAN TRAIL,	NOSE CLEARANCE, °	NOSE RADIUS, IN.	SECONDARY CLEARANCE, ° FOR CARBIDE-TIPPED TOOLS
Chilled iron, very brittle brass & bronze	0	0	6	3	10	10	3	.080	2 – 3
Steel & steel castings of more than 45 tons tensile, hard casting & malleable iron of more than 200 Brinell, hard brass & bronze	4	0	6	6	10	10	6	.040	2 – 3
Steel & steel castings of 30 to 40 tons tensile, cast iron of less than 200 Brinell. Ordinary brass & bronze, stainless steel	8	4	6	6	10	10	6	.030	2 – 3
Steel of 20 to 30 tons tensile, soft cast iron	12	4	6	6	10	10	6	.030	2 – 3
Soft bronze, hard aluminum alloys	15	10	6	6	10	10	6	.015	2 – 3
Soft aluminum alloys	25	15	6	6	10	10	6	.015	2 – 3
Soft copper	25	25	6	6	10	10	6	.015	2 – 3
Elektron	15	15	6	6	10	10	6	.015	2 – 3

It is evident that 19 variables must deter practical men from approaching such a difficult problem, but research departments all over the world were not disheartened. They tackled one detail after the other[18-42], isolating the one variable which was most important for the case. How is it possible to eliminate one of 19 variables and yet obtain a useful result? The practical answer is given by standardizing tools and working conditions on the basis of the results and arranging them in such a way, that, for example, for a new piece-material or a new tool-material, only this new quantity remains unknown.

So we find a standardization of the tool shape, and its approximate accommodation to the various ferrous and non-ferrous materials (Table II), including tool material, hardness and sharpness. The hardness is determined by such a tool as the Vickers hardness tester, the sharpness by comparison tests on calibrated material at the beginning and the end of a series of tests. For the tool material we know sufficient details, from the old carbon steel to the most modern cemented carbides. The 11 variables of the tool could be standardized and therefore all eliminated as variables.

Cutting Conditions: For speed, area of chip and coolant we again have useful approximate data, so again four variables are changed into standardized values.

Material of the Piece: This is the domain of the designer. Requirements for larger resistance and higher speeds are daily made for such products as airplanes, motor cars, machine tools, diesel engines, etc. The production manager must follow, adapting tools and machine to the raised requirements. He measures the increased resistance by the increase of power and rigidity required from his existing machine tools by trial-and-error tests, but demands that the abrading influence of new materials be kept low by the steel mills. Thus unlike soft pure copper, or tough stainless chromium and manganese steels, the abrasion number of the new material remains about the same as that of the steels between 30 to 80 tons/sq. in. tensile. If we call this abrasiveness No. 1, we have reduced the machinability of workpieces to the three components of the main cutting force acting between workpiece, tool and machine tool, as that force which determines the time for machining, the type of the tool, the tool life and the power drive of the machine tool.

Since 1900, when F. W. Taylor showed in Paris the first Taylor-White high-speed tool with 7% tungsten, turning, with a red-hot tool nose, investigation has been concentrated on tool life, beginning with 20 min. endurance (v_{20}). Shapes of tools and their life was measured by 3-component dynamometers, which can measure the tangential, radial and feed forces of the tool action.

There have been found very good solutions of the basic problem, using hydraulic, electrical and mechanical instruments, all complicated, all restricted in use to laboratories or research departments. They worked in the shop, it is true, but they could be controlled only by the evidence of practical experience. The three components, plotted as graphs (Fig. 17) always show an almost straight-line course, so the tangential force has the commanding influence. On this basis, a 3-component-dynamometer (Schiess-Siemens System) has been developed by the British Research Department.

About 1937[x], the idea of a machinability index was suggested, dropping the proportionate values of the relatively small radial R and feed F forces and using the tangential force T referred to the cross-section of chip A as criterion of the machinability $\left(\frac{T}{A}\right)$ of the varying material measured in psi. (Table III.) Now to characterize the cutting resistance of materials with known abrasiveness, two of the three components are eliminated, and of 19 variables all are standardized but one: the machinability $M = \frac{T}{A}$. The measuring instrument is simplified to a one-component[xx]

x) Practical Lathe Capacity Tests—*Machinery*, (London), 20 May, 1937
Capacity Tests on a Shaping Machine—*Machinery* (London), 30 Sept., 1937

xx) Der Siemens Schnittkraftmesser (Schallbrock und Schaumann), Siemens Zeitschrift, Berlin, Jan.-Feb., 1940. No. 1—Electrical Indication
O. W. Boston—One-component Dynamometer Using Dial Gage as Indicator

TABLE III—1937 MACHINABILITY INDEX

(1) LATHE

1	2	3	4	5	6	7	8	9
Test No.	f Const. Feed in.	d Depth of Cut, in.		A Area of Chip, sq. in.	v Cutting Speed, fpm.	fv Tangent Force, lb.	M Index, 1000 lb. psi	Input to Motor, kw.
1	.035	.076		.0027	72	660	241	1.90
2	.035	.076		.0027	61	645	235	1.65
3	.035	.114		.0040	82	1002	249	2.89
4	.035	.117		.0041	73	1002	242	2.64
5	.035	.158		.0055	85	1380	244	3.69
6	.035	.168		.0059	64	1470	250	3.00
7	.035	.189		.0066	72	1650	240	4.13
8	.035	.267		.0093	74	2250	235	5.57
9	.035	.265		.0092	66	2250	238	4.93
10	.035	.307		.0107	65	2520	237	5.5

Material: Steel 32/35 tons psi. Average 242 ± 3%

(2) SHAPER

1	2	3	4	5	6	7	8	9
Test No.	Strokes per min.	L Length of Stroke, in.	d x f Depth x Feed in. in.	A Area of Chip, sq. in.	v (mean) Cutting Speed, fpm.	T Tangent Force, lb.	M Index, 1000 lb. psi	Input to Motor, kw.
1	12	21.65	idle	—	35	—	—	2.67
2	"	"	.04 x .04	.00155	"	373	238	3.64
3	"	"	.08 x .04	.0031	"	755	242	4.18
4	"	"	.12 x .04	.0047	"	1145	244	5.26
5	"	"	.158 x .04	.0062	"	1540	245	5.74
6	"	"	.158 x .05	.00775	"	1880	239	7.28
7	"	"	.158 x .06	.0093	"	2250	238	8.43
8	"	"	.158 x .08	.0124	"	3020	242	9.63
9	"	"	.195 x .08	.0155	"	3770	241	11.27
10	"	"	.235 x .08	.0186	"	4480	238	13.22

Average 241 ± 2%

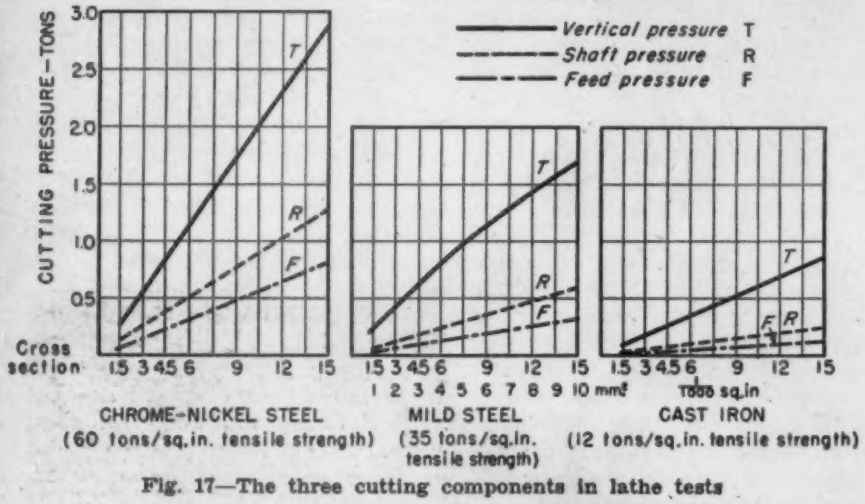


Fig. 17—The three cutting components in lathe tests

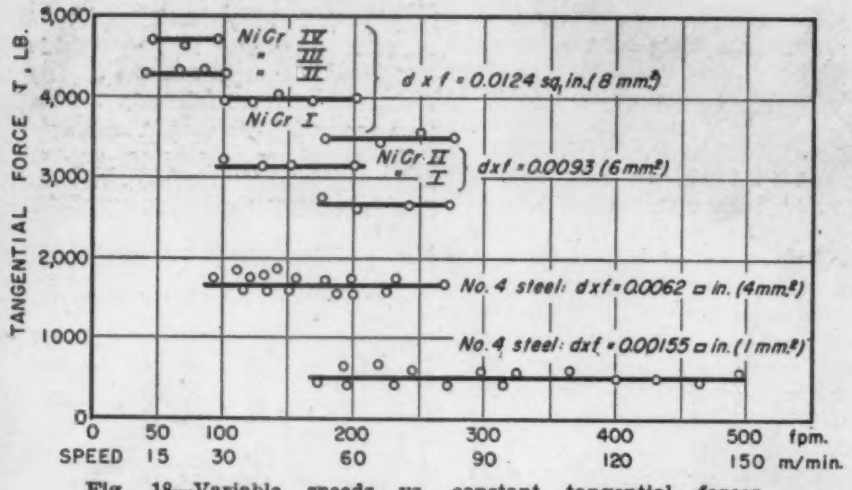

TANGENTIAL FORCE T, LB.
NiCr IV
NiCr III
NiCr II
NiCr I
d x f = 0.0124 sq.in.(8 mm²)
d x f = 0.0093 (6 mm²)
No. 4 steel: d x f = 0.0062 □ in. (4mm²)
No. 4 steel: d x f = 0.00155 □ in. (1 mm²)
SPEED
fpm.
m/min.

Fig. 18—Variable speeds vs. constant tangential forces (tests with a 3-component dynamometer during 1924 to 1926)

dynamometer, which looks like a box-tool of a capstan or combination turret lathe. The deflections of the cantilever weighing element below the tool are measured by the usual dialgage of 0.0001 in. per division. multiplied by a magnifying lever 2:1 which makes it possible to read even 0.00005-in. deformation (Fig. 19). Machinability indices are measured by the tangential force *T* in pounds per 0.001 sq. in. using the standardized cross-section of chip as a reference. This reduces reading to three digits, e.g., 260 per 0.001 sq. in., instead of 260,000 per sq. in. These figures are similar to Brinell, Rockwell or Vickers readings, and are easy to understand by shop executives. The ratio of depth: to feed should be:

$\frac{4}{1} = \frac{0.064}{0.0156}$ or $\frac{5}{1} = \frac{0.0715}{0.014}$, where

$0.064 \times 0.156 = 0.0715 \times 0.014 = 0.001$ sq. in.

Such a small section can be taken on an ordinary lathe of 2 to 3 hp. with fairly low speeds (Fig. 20), because reliable investigators found that the tangential cutting force remains uninfluenced by cutting speeds between 30 and 50 fpm. used most commonly in present well-equipped shops. When they are increased in future, the total range of machinability indices (Table III is correspondingly somewhat decreased, but this does not disturb the principle of a criterion for all materials.

Direct Tool-Life Test

We know from Table IV that the useful cutting speed depends on the machinability index. As the one-component dynamometer is a rigid measuring instrument, it can now be used directly for tool-life tests by speeding up the machine to an adequate cutting speed, and increasing the chip area to the ordinary workshop dimensions of about 0.006 sq. in. (1.5 to pressure). Now the tool should last for an hour as the minimum time; its endurance or exhaustion is checked by observing the tangential force shown on the dial gage, (the hand rises when the tool edge is blunted). Generally, an increase of 10 to 15% in force compared with the force exercised by the sharp tool indicates the tool edge has begun to blunt, and a bright ribbon on the surface of the workpiece shows soon after the increase of force on the end of the tool. A power gage, ammeter (dc) or wattmeter (ac) at the machine shows a sudden increase of power at the same moment.

TABLE IV

Tool Life and Machinability Compared to Provide Indexes for 14 Materials

(Based on tangential force (T) per 0.001 sq. in.)

MATERIAL	Tensile Strength tons per sq. in.	Brinell Hardness	Tangential Forces in 1000 lb. related to cross-sections area of chip in sq. in.				Machinability Rating (Index Cipher) related to 0.001 sq. in. Tolerance ± 10%	Recommended Cutting Speeds V_{60} fpm.		
			0.001 0.645 mm²	0.00155 1 mm²	0.0031 2 mm²	0.0062 4 mm²		High Speed Steel (18-4-1)	Super High Speed (Co+18-4-1)	Cemented Carbides
Steel (Screwstock)	18–22	80–100	205	190	178	160	205	60–80	100–120	400–600
Steel "	25–30	120–140	230	220	198	180	230	40–60	60–90	250–400
Steel (semi-hard)	35–40	150–180	250	240	225	198	250	35–55	50–80	220–325
Steel (hard)	42–50	180–220	320	300	265	250	320	30–45	45–70	175–250
Steel (Cast Steel)	52–60	230–270	520	500	480	470	520	25–40	35–60	150–200
1.5 Ni Cr Steel	45–55	200–230	350	340	320	295	350	35–50	50–70	175–250
3.5 Ni Cr Steel	58–70	250–310	510	500	490	480	510	20–35	30–50	125–200
Steel Casting	25–30	135–160	252	245	232	198	252	35–60	70–90	150–300
Gray Iron Casting	14–16	170–190	145	140	130	120	145	40–60	85–100	180–350
Brass	26	115	138	128	108	88	138	100–140	150–200	400–800
Bronze	34	140	162	150	142	132	162	70–100	100–150	300–550
Silumin	16–20	70–90	122	115	96	86	122	100–140	150–200	500–800
Aluminum (Extr)	12–20	30–70	87	84	78	74	87	150–225	250–300	800–1000
Elektron	14–20	40–60	42	39	35	32	40	200–300	300–400	1200–2000

Therefore, this one-component dynamometer attains simultaneously the objectives for an instrument which gives first the machinability of the material as resistance in pounds per 0.001 sq. in., found with low speed and any tool in about 5 min., turning a length of 1 to 2 in. and allowing 5 to 10 quick repetitions each within about 1 min. because the machine is already set up. It allows, secondly, determination of tool life by inserting perhaps a new tool of another material and increasing the cutting speed until the tool is spoiled.

If values of permissible cutting speeds, taken with three kinds of tools—HS, SHS and cemented carbide—tabulated in Table III, are plotted against the machinability index of a known component, they show decreasing speeds with increasing index (Fig. 20). Cutting speeds of this table were so chosen in all cases that the blunting time corresponded to 60 min.; it is the standardized time (v_{60}) for life tests.

The "scatter" of the upper and lower limits of speeds depends naturally upon the differences in the tool material used; they are within reasonable shop limits. The only exception occurs with gray cast iron, which according to existing tests requires lower speeds despite a lower index than the uniform steels. This seems to be a consequence of the rather high abrasive number (about 15) of cast iron, caused by graphite crystals and segregations.

The uniform and dense types of cast iron (e.g., Meehanite) will follow the ordinary machinability rules for steels. Diagrams plotted in the log-log system give approximately straight lines ($v \times t^n = C$).

The power drive can be controlled

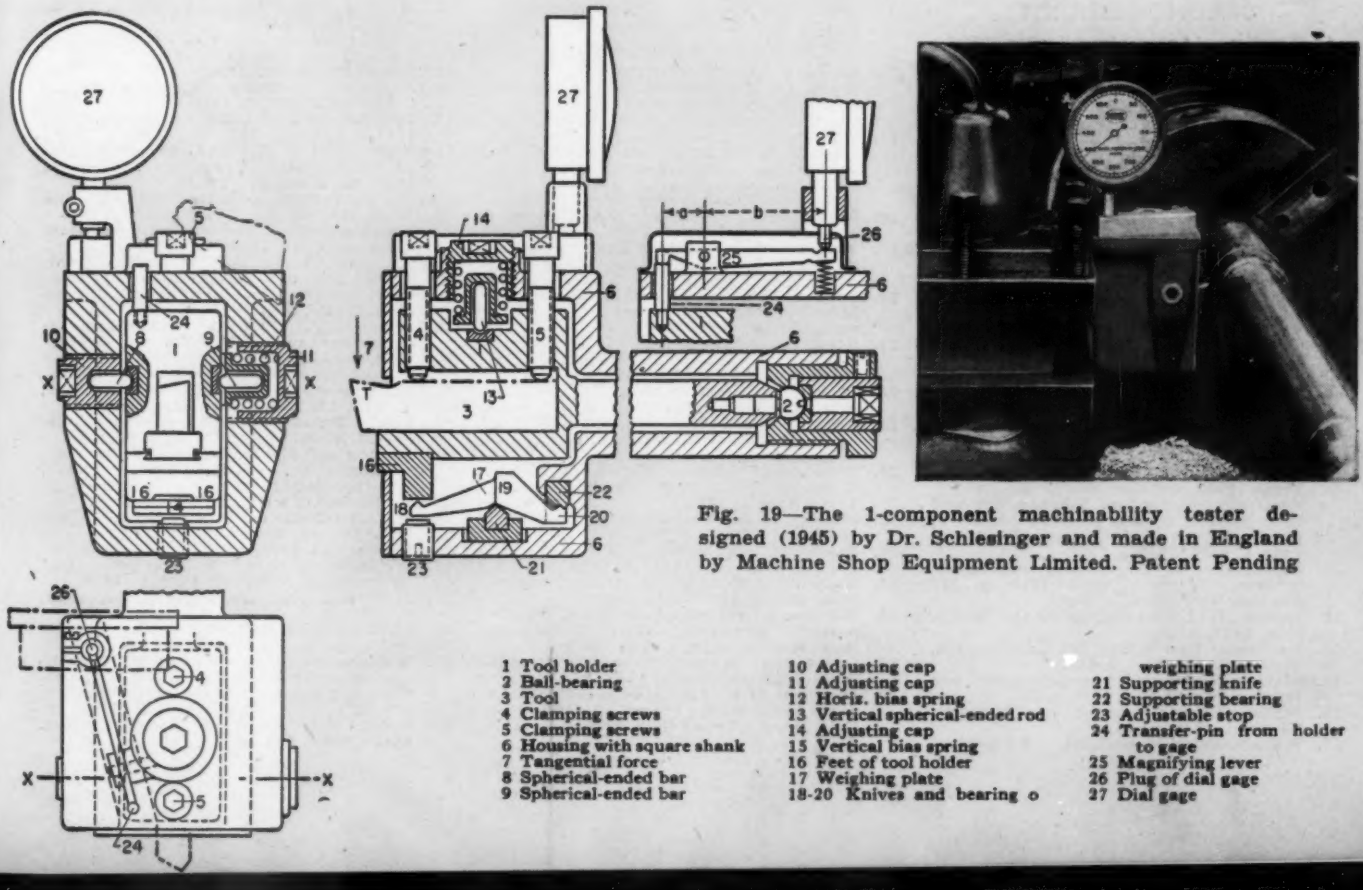


Fig. 19—The 1-component machinability tester designed (1945) by Dr. Schlesinger and made in England by Machine Shop Equipment Limited. Patent Pending

1 Tool holder
2 Ball-bearing
3 Tool
4 Clamping screws
5 Clamping screws
6 Housing with square shank
7 Tangential force
8 Spherical-ended bar
9 Spherical-ended bar
10 Adjusting cap
11 Adjusting cap
12 Horiz. bias spring
13 Vertical spherical-ended rod
14 Adjusting cap
15 Vertical bias spring
16 Feet of tool holder
17 Weighing plate
18-20 Knives and bearing o weighing plate
21 Supporting knife
22 Supporting bearing
23 Adjustable stop
24 Transfer-pin from holder to gage
25 Magnifying lever
26 Plug of dial gage
27 Dial gage

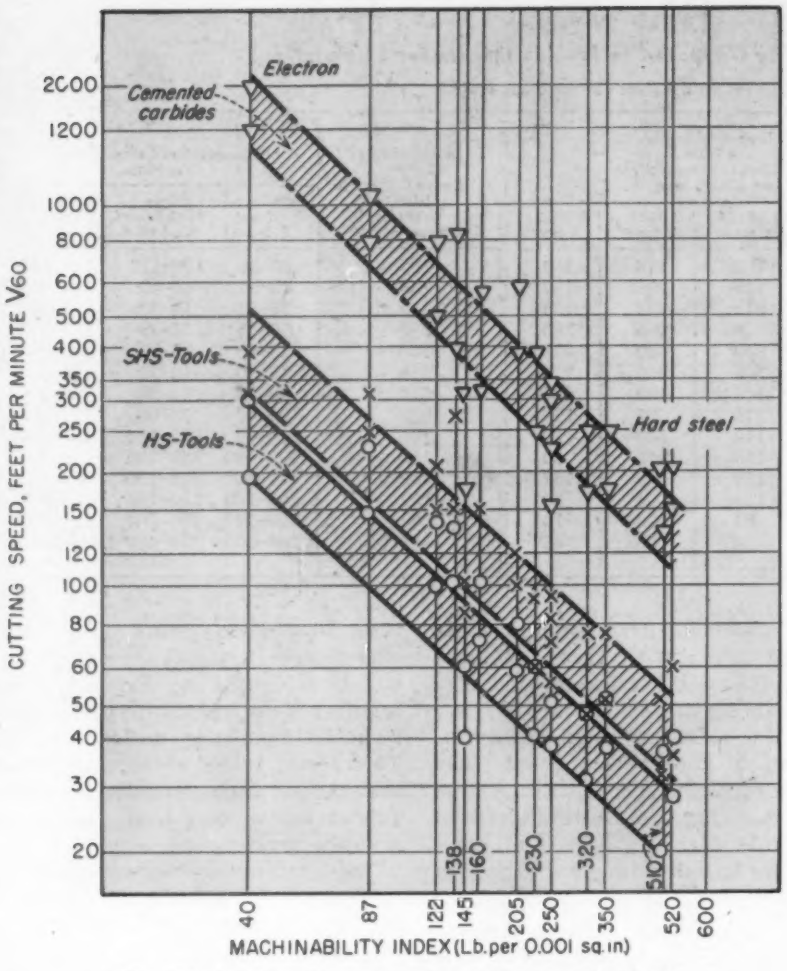


Fig. 20—Log-log diagram of cutting speed (v_{60}) vs. machinability index for three types of tools

by an ammeter at the same time without additional work, which determines the size of the machine tool. The turning test keeps cutting conditions constant for all lengths, and is radically superior to the drill test which depends upon the depth of hole; furthermore it makes it possible to control the influence of coolant in any quantity and at the right place. The shape of the tool is easily reproduced in spite of the many angles, particularly if a well-designed set of grinding fixtures exist which secures the correct rake and clearance angles (cf. Table II) for the roughing tests and the right nose radius and clearance of nose for finishing tests.

This instrument is simple, cheap and rigid and is within the knowledge and experience of the ordinary shop. Operation of the one-component dynamometer can be learned by any attentive semi-skilled operator, because the measuring mechanism is self-contained and independent of electrical current.

That the results of turning tests for machinability can be transferred as a reliable basis for planing, drilling and milling is confirmed by many valuable studies over more than 20 years. These prove the science of machinability is out of its teens, but one must know and utilize the existing valuable research work of the U. S., Great Britain and Continent.

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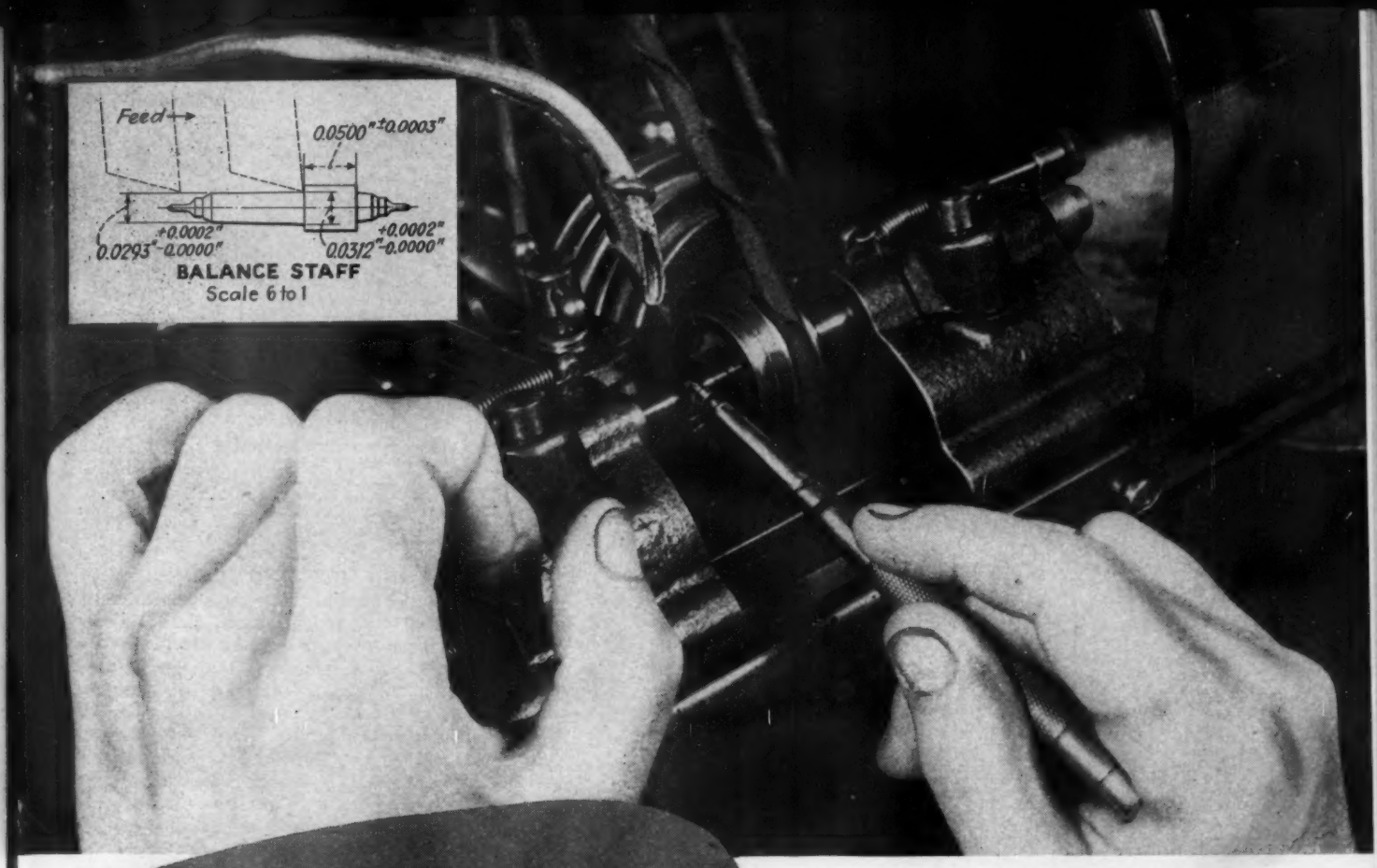
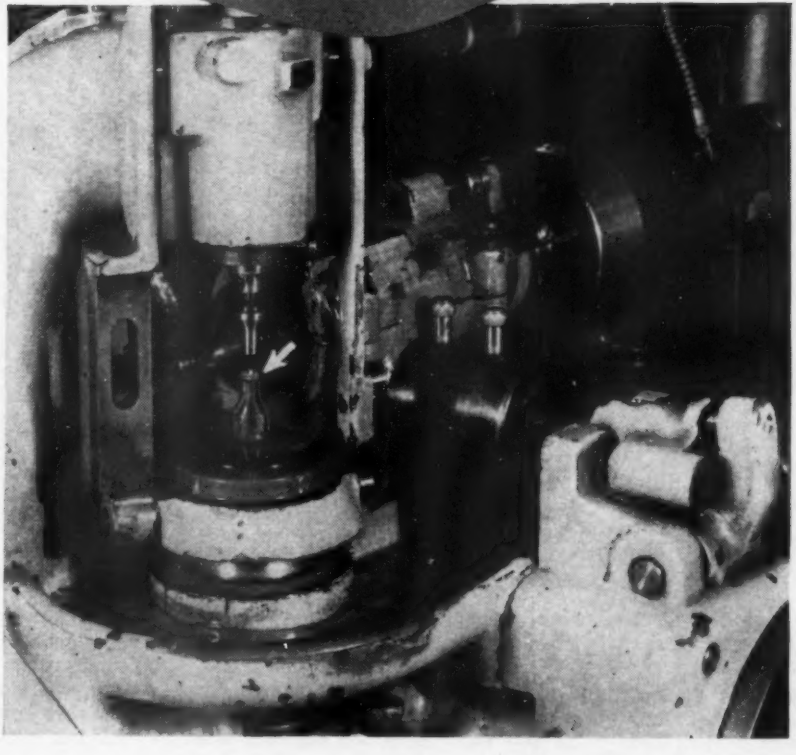
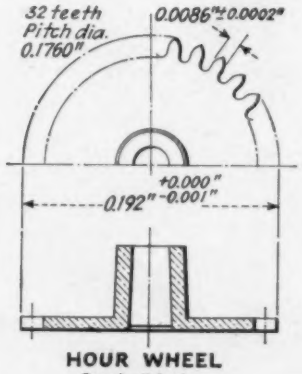


SHOP SHOTS
AT HAMILTON WATCH

BY ROBERT LOOMIS



TOLERANCE IN TEMPO—Balance staffs and other small parts are turned and faced in miniature semi-automatic lathes. Back-geared cams control transverse and longitudinal feeds of a carbide-tipped tool carried on the compound rest. The staff, dogged by the operator, is placed between centers by a dog wrench. A finger on the headstock pulley contacts the dog and drives the work. Extremely smooth surfaces with diametrical tolerances of +0.0002, —0.0000 in. are easily produced



HOBBING HOUR WHEELS—On this vertical hobber, 32 teeth are generated on the tiny brass hour wheel mounted on the arbor with a machine cycle of 25 sec. Over-all tolerance of 0.0004 in. is allowed for tooth thickness, although the teeth on any one wheel must not vary more than 0.0003 in. The hobs are designed and made in Hamilton's shop, and only extreme care in their manufacture makes possible the limiting tolerances on the work

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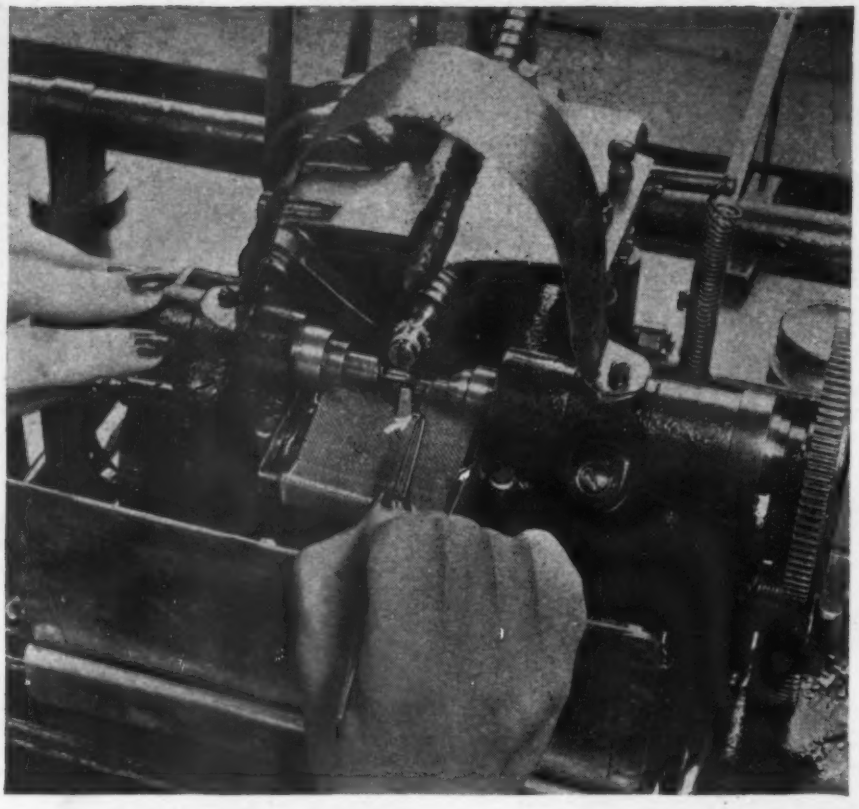
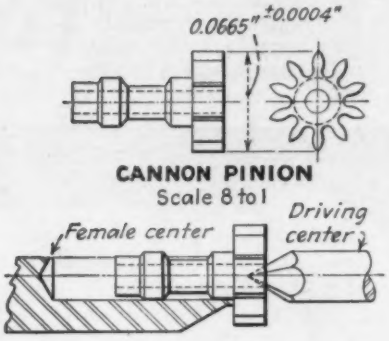
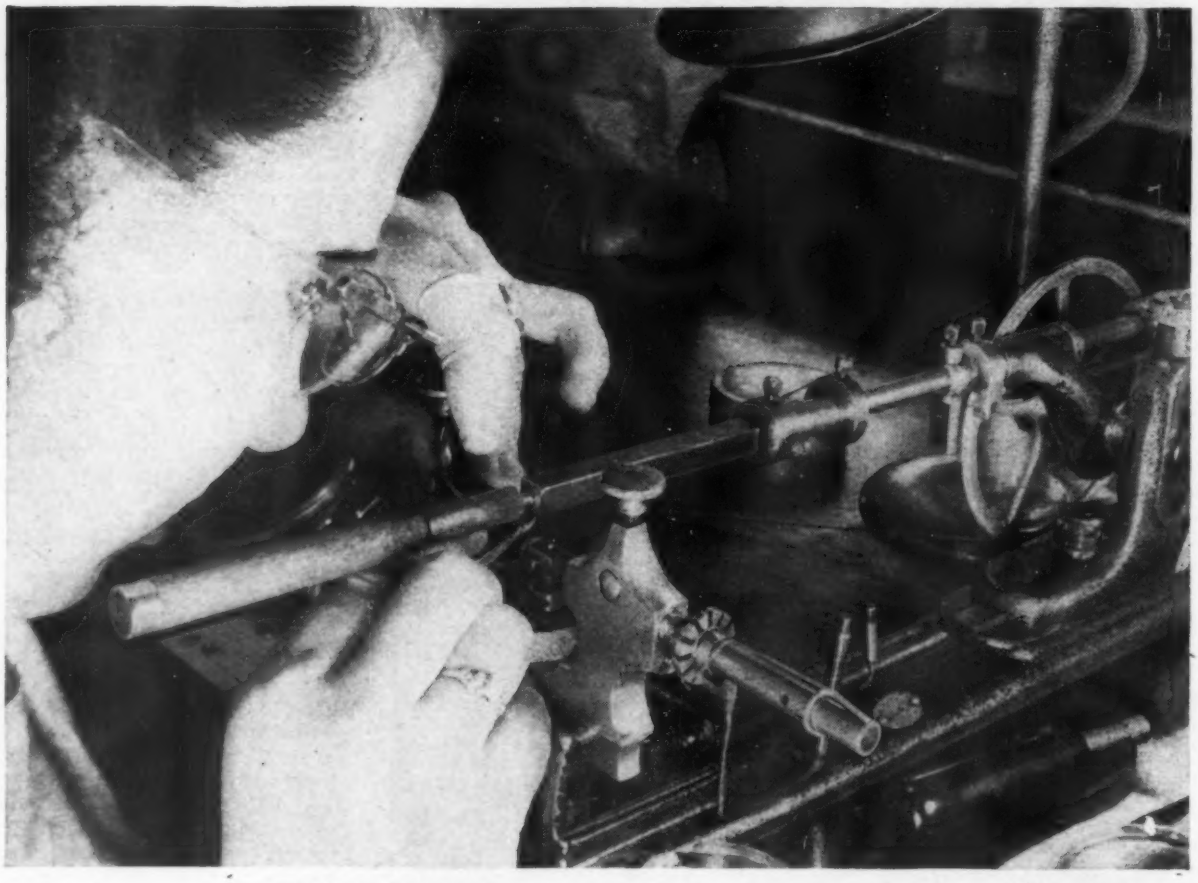
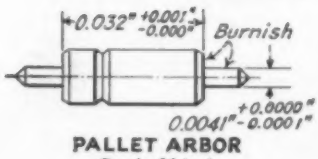




CANNON PINION
Scale 8 to 1

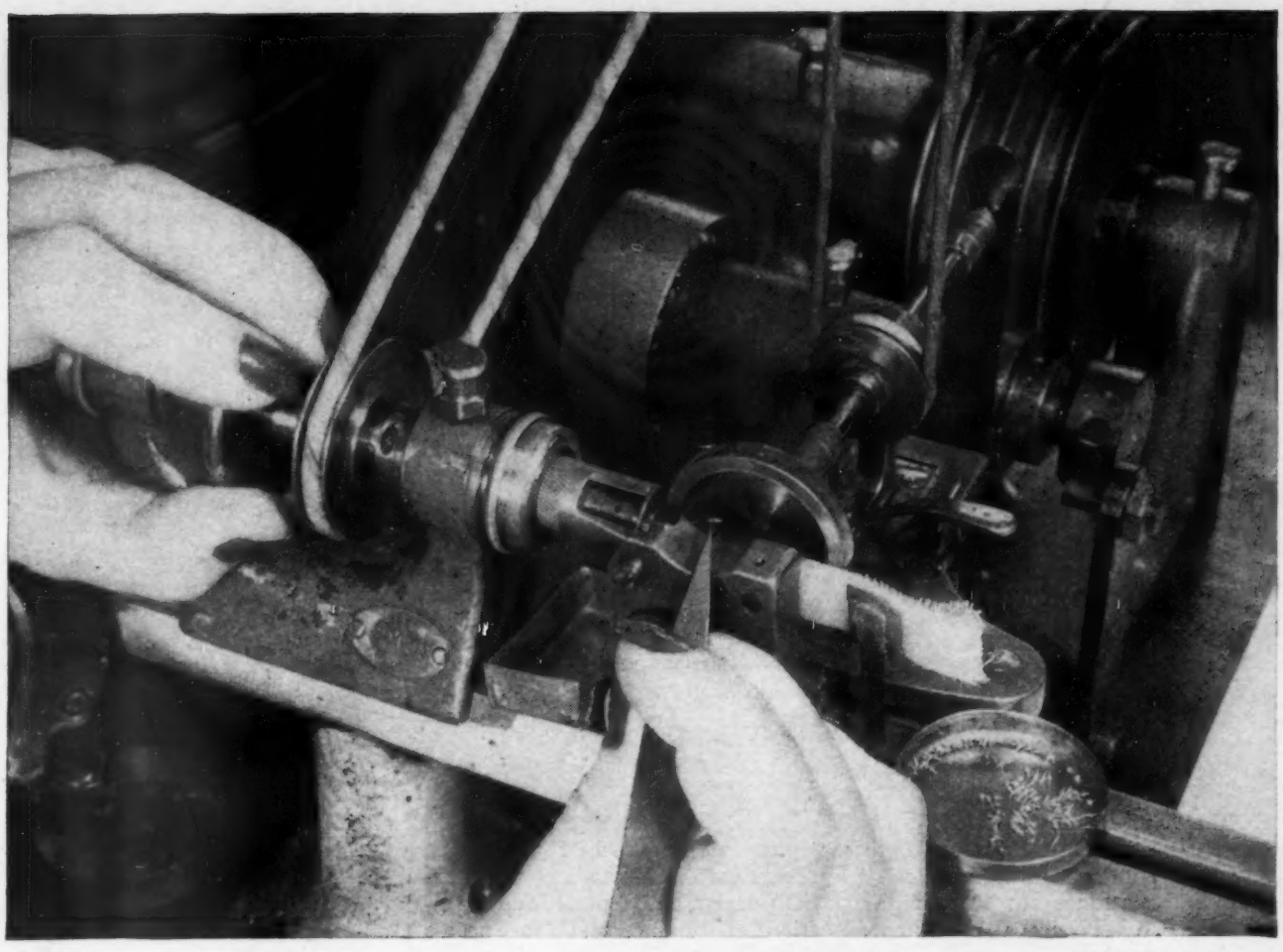
PINION CUTTING—Uniform teeth cut to over-all ring-gage tolerance of 0.0008 in. are produced in a Hamilton-built pinion cutter. Held in the operator's tweezers is a cannon-pinion blank to be placed between centers. A five-pronged male center drives the pinion for indexing after each cut. The female center that supports the work is cut away on top to provide clearance for the cutter. Cut is toward the pronged center to insure positive indexing



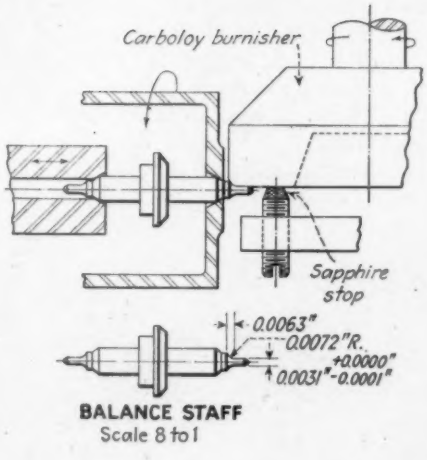


PALLET ARBOR
Scale 24 to 1

PRECISION PLUS—Pallet arbor pivots of $0.0041\ ^{+0.0000}_{-0.0001}$ are burnished by a carbide bar, drawn back and forth by the operator across the pivot. The arbor is held in a hollow center on the left side while the pivot to be burnished rides in a carbide V-rest, the back side of which acts as a stop for the burnisher. The arbor, previously dogged, is rotated against the burnishing bar by the cord belt. Precise operations such as this provide the interchangeability needed in the manufacture of watch parts



CONE PIVOT BURNISHING—The operator is chucking a balance staff to burnish the cone pivot. The machine is semi-automatic and burnishes the pivot diameter to a 0.0002-in. tolerance in approximately 3½ sec. A spring cam follower feeds the carbide burnisher to the work until it contacts a sapphire stop. Hardness of the sapphire makes working to this tolerance a practicable production job



BALANCE STAFF
Scale 8 to 1

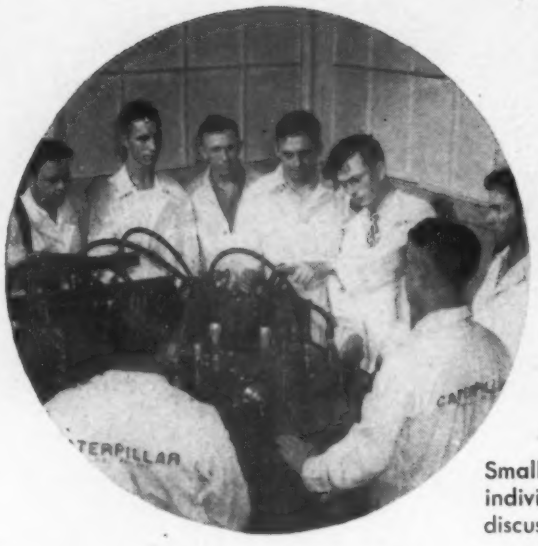
THE GREEKS HAVE A WORD FOR IT
Damaskeen *(Greek: to decorate)* is the decorative finish on the plates and bridges of finer watches. Here a straight-line, damaskeened pattern is being applied to a nickel-silver bridge. A hollow lap of vegetable ivory, packed with dry Alundum powder, revolves at 19,500 rpm., while the work is fed back and forth in a straight-line motion. Powdered oilstone, mixed with olive oil, is applied to the work surface to prevent burning of the lap. Pressure and angle at which the lap contacts the work are controlled by hand, while work travel is regulated by pedal clutches. Uniformity of pattern and finish depend on the operator's skill

Hydraulics 'Know-How'

TAUGHT TO APPRENTICES

BY P. G. GRIEBEL, INSTRUCTOR,
Special Training Division, Caterpillar Tractor Co.

Mystery surrounding hydraulics led Caterpillar to install a well-planned course which drew enrollments from tool-repair and machine-design employees



Small-group instruction permits individual participation in discussion and demonstration

NORMAL REPLACEMENT and expansion brought installation of both standard and special hydraulically actuated machines at Caterpillar Tractor Co., Peoria, Ill. Pumps, valves and piping replaced gears, cams, levers and shafts. At the outset, maintenance and repairmen were able to obtain only limited knowledge of trouble diagnosis and remedy. Available information dealt in the main with derivation of formulas and design.

Cut-and-try repair methods proved costly in machine down-time. Gradually, service experience on hydraulic equipment minimized maintenance problems. Too frequently, however, a tedious and expensive tear-down could have been avoided by a better understanding of basic theory. The remedy often involved only a minor adjustment or part replacement.

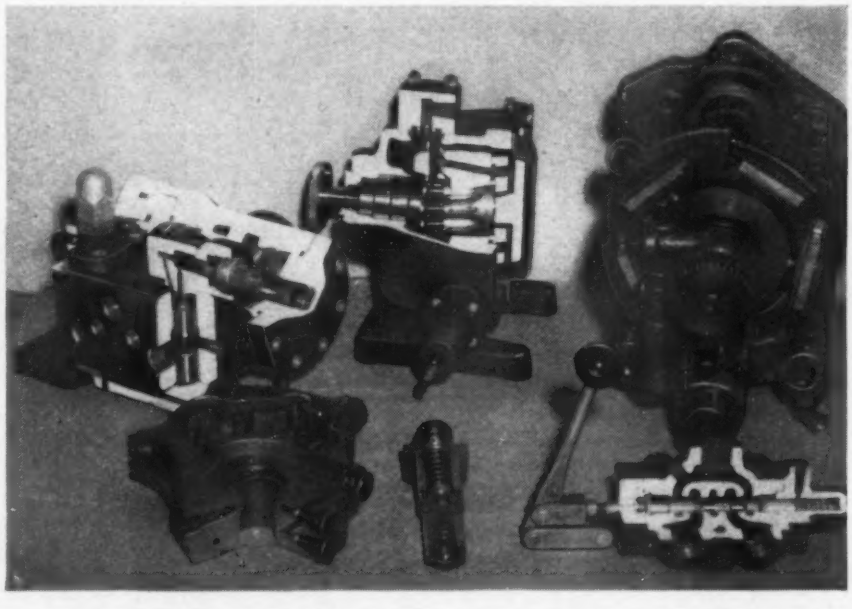
As misconceptions of purpose and operation of some hydraulic-circuit components were almost inevitable, a training program based on fundamental principles of hydraulics and their application to machine tools seemed in order.

While development of a course on hydraulics was under consideration for the apprentice training curriculum, requests from machine repair and tool design departments for a similar program emphasized need for a practical approach. Group discussion by interested departments determined the course should eliminate "mystery" surrounding the subject, emphasize fundamental principles, present careful analysis of problems (both design and repair), and application of fundamentals to specific jobs so factors influencing improper operation of a particular machine might be logically separated from those of no bearing.

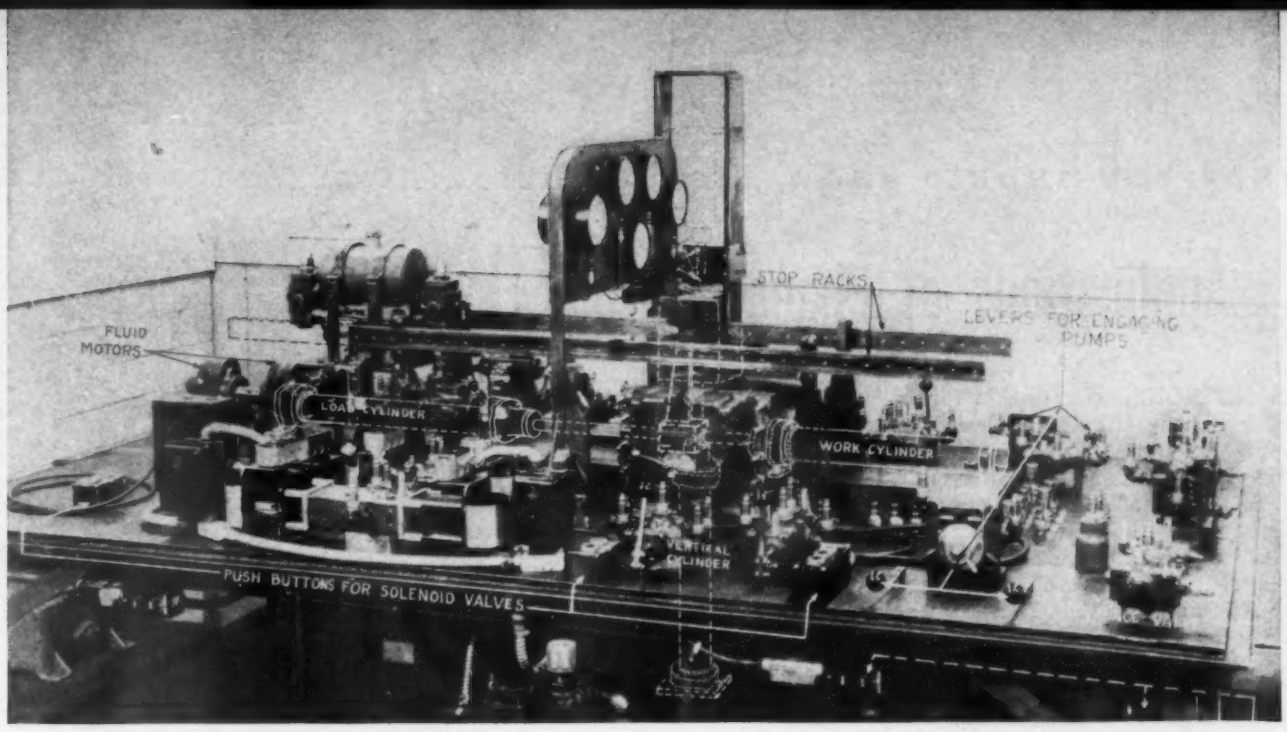
A plant-wide survey of hydraulically actuated equipment was made and manufacturers contacted. A training-staff member was invited to work on assembly and repair at a manufacturer's plant. He obtained first-hand information on repair and service operations, and the engineering and sales departments helped in the field of application.

Training aids in the form of cut-away models, multi-colored circuit diagrams, and lantern slides were prepared. Several demonstration tables, mounted with representative pieces of hydraulic equipment, were devised for actual demonstration of operating principles.

After about a year of preparation,



Typical cut-away demonstration models of hydraulic equipment are exhibited. Exposed sections simplify understanding of construction and function



Practical training in the use of hydraulic equipment is accomplished by this demonstration stand bearing four different types of pumps and control equipment. A 300-lb. lead weight serves as a load for the vertically mounted cylinder, while a load cylinder offers resistance for the horizontally mounted work cylinder. Stop racks, on which cams and dogs may be mounted for valve or panel actuation, are caused to reciprocate through direct connection with the horizontal work piston rod, thus simulating actual machine movements. A variety of actual working circuits can be connected and analyzed. Faulty adjustments can be incorporated to introduce a "bug" for analysis.

the course was incorporated in the machinist apprentice curriculum. One hundred and fifty employees of the machine-repair and tool-design departments enrolled. The work for this group was offered on the employee's own time with all necessary equipment furnished by the company. Classes of 10 men met once each week for two hours over a period of 10 months, either before or after the regular work shift. Tool designers attended class with repairmen, affording each the benefit of the other's experience and problems.

The course was divided into five major units: basic physics and hydraulics, pumps, valves, combination units, and special circuits. About 12 hr. were devoted to study and demonstration of basic principles of physics and hydraulics, including such points as the relative incompressibility of liquids, Pascal's Law, work, power, horsepower, conservation and transformation of energy and the flow of fluids.

This served as a background for investigation of pumps, how they are primed, factors affecting volumetric efficiency, delivery and possible malfunction.

Valves were considered in the order of frequency of appearance in hydraulic circuits, hence in the order of importance. Basic fundamentals appeared again and again in discussion of hydraulically balanced and pilot-operated models. Each unit was studied from the cut-away model for theory of operation, demonstrated on the table in operation, and finally applied to simple circuits for application.

Students Analyze Circuits

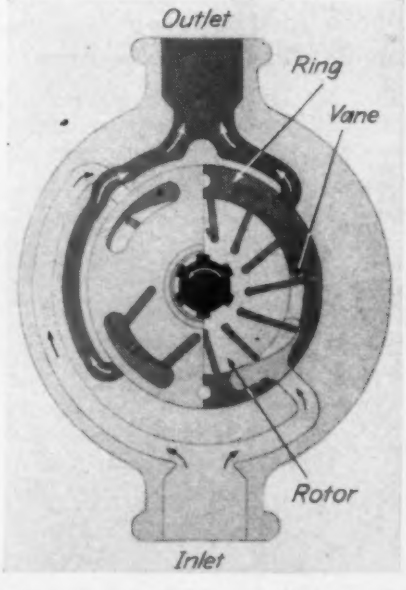
Gradually, a combination of various items evolved as a unit designed for a specific purpose by the manufacturer. What formerly seemed an intricate hydraulic device now became relatively simple because the function and operation of the components had been studied individually and each phase mastered.

At the start of each meeting, students answered review questions summarizing the previous session. Questions of the multiple-choice type asked specific points about a particular principle of physics, valve operation, or required pressure setting. Application and design questions were introduced, giving students the opportunity of analyzing circuits by connecting components and adding required equipment to produce a described combination of movements.

The value of this special training program has evidenced itself on many occasions. Repairmen are more inclined to analyze the actions of an improperly operating machine before applying a wrench. This helps in getting "down" machines back into proper operation more rapidly.

A better understanding of the performance of hydraulic equipment—its possibilities and limitations—will undoubtedly result in a greater degree of correct application to tooling designed in the plant.

Addition of the hydraulics course to the machinist apprentice curriculum is in keeping with the phrase, "You can't do today's work with yesterday's equipment and be in business tomorrow."



Multi-colored charts simplify study of theory, equipment and application

Applications of Phanotron and Thyratron Rectifiers

PHANOTRONS, operating in three- and six-phase circuits, are used to supply dc. power for the fields of large dc. motors and generators.

Phanotrons are used in charging the batteries in central power stations. Here the phanotron operates as a reliable source of dc. power, maintaining the battery charge without noise or wear and requiring a minimum of maintenance.

The thyratron tube is basically a phanotron with a grid added, and as such can be used in the same rectifier circuits. By applying a control voltage to the grid of the thyratron, the time in the cycle at which conduction starts can be retarded to get just the amount of power needed. Therefore, when an adjustable voltage output is required, a thyratron is used in place of the phanotron.

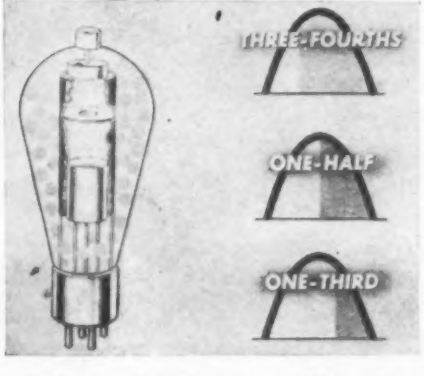
Thyratron circuits, such as in the Thy-mo-trol panel, supply direct current for variable-speed motors. They control the power to both the armature and field, thereby controlling power and speed.

When applied to synchronous motors or generator fields, thyratron rectifiers can be easily controlled to hold constant output, or constant power factor, as desired.

The thyratron is also used in energy-storage welding to charge capacitors to the exact dc. voltage required.

Rectifier Tubes for Large Power

Rectifier tubes and equipment employed in the large power field include the mercury-pool types of rectifiers, the sealed ignitron, the pumped ignitron, and the multi-anode tank.



Use of a thyratron in rectifier circuits makes the voltage adjustable

The sealed ignitron is widely used in the low-voltage power field in rectifier equipments, converting up to 1000 kilowatts at 600 volts.

Dc. unit substations use sealed ignitrons to supply direct current right at the factory load center. The typical dc. unit has six sealed ignitron tubes, cooled by tap water.

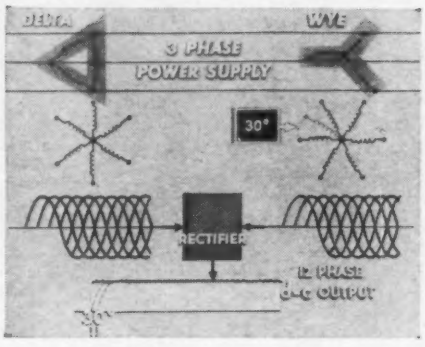
Mounted on a trailer, the substation provides a convenient, portable source of direct current of great flexibility, to supply shipside power for drydock use. Both stationary and portable systems of this type are used to supply direct current for mining operations.

The heavy dc. power field employs the pumped-type ignitron and the multi-anode tank. Pumped ignitrons are usually employed in banks of six or twelve. The multi-anode tank, which as a common cathode and multiple anodes within a single tank, handles six or twelve phases per unit.

In the previous discussion of six-phase rectifier circuits, the outer terminals of the six transformer secondaries were connected to the anodes of six rectifier tubes, and all cathodes were tied to a common load. The ignitron rectifiers are connected in this same manner. When the multi-anode tank is used the transformer secondaries are each connected to one of the anodes in a common rectifying tank. The mercury pool that supplies electron emission to all anodes is connected to the load.

Where a twelve-phase operation is desired, twelve ignitrons can be employed. These will be connected into a transformer arrangement based on the six-phase circuit, but in this case employing two separate primary and secondary units.

Note that the primary of the standard six-phase unit is connected as before in what is called the Delta connection. But on the right unit, the primaries are connected as a Wye. The secondary voltages are now shifted one-twelfth cycle, or 30 electrical degrees. Now, when the outputs of these two units are rectified and combined, the voltages



Combining the Delta and Wye connections produces a smooth dc. current

overlap smoothly, producing only a very small ripple in the final dc. output. This, then, is twelve-phase rectification. In a similar manner any desired number of rectifier phases may be built up from the basic six-phase unit.

Kenotrons are used to supply low currents and high voltages as required in the rectifier unit for a precipitator. Because of their low cost, kenotrons are also used in many small rectifiers.

Phanotrons are used in general-purpose rectifiers of various sizes, such as a five-ampere unit which might supply the direct current for a surface-grinder chuck.

Water-cooled sealed ignitrons, the smaller of the mercury pool tubes, are used in dc. unit substations. These substations can supply hundreds of kilowatts of power where it is needed on the factory floor.

And finally there are the large pumped ignitrons and multi-anode tanks used in modern substations which supply the thousands of kilowatts needed for electric transit systems. The quiet and dependable operation of these mercury-tube rectifiers permits their location in residential districts.

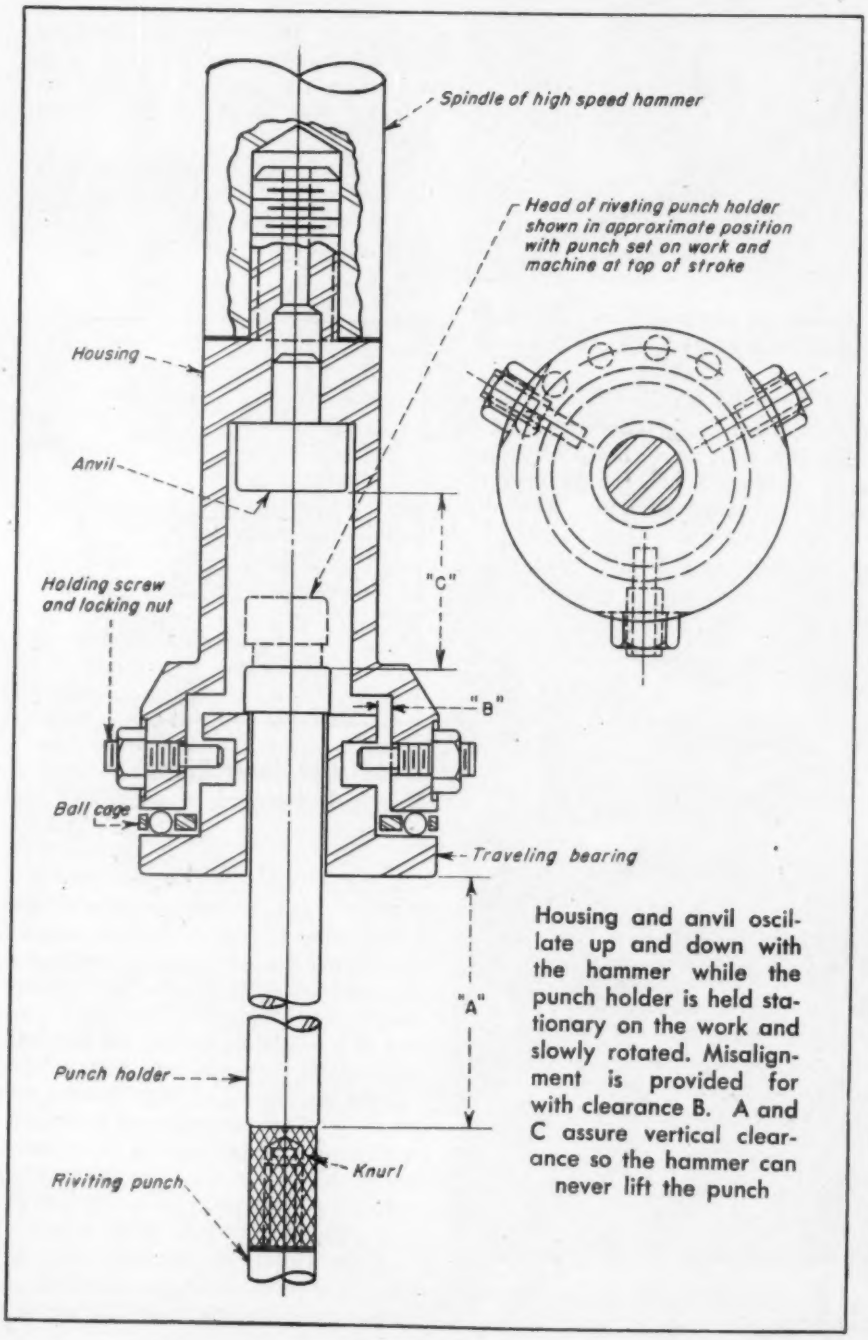
In the large electrochemical plants where the light metals, aluminum and magnesium, are produced by the use of tens of thousands of kilowatts of dc. power, great banks of electronic rectifiers have replaced most other forms of conversion units.

Based on a sound slidefilm in the General Electric industrial electronics course.

Practical Ideas

Floating Punch Holder Aligns Itself In High-speed Riveting

HERBERT WEITZ
Union, New Jersey



Housing and anvil oscillate up and down with the hammer while the punch holder is held stationary on the work and slowly rotated. Misalignment is provided for with clearance B. A and C assure vertical clearance so the hammer can never lift the punch

One of the most frequent complaints in riveted, staked and curled assembly work where the high-speed hammer is used is faulty registration between the punch and work.

This difficulty is not always easy to overcome because dimensional variations develop sometimes, and machine wear may contribute to the misalignment between the punch and the work. Irregularly shaped or deformed heads are then produced resulting in rejection and scrapping of the work.

This traveling punch holder made for the high-speed hammer has been found to correct these conditions and produce consistently good assembly work in spite of many possible variables.

Regardless of the type of work being done and the punch used, the knurled punch holder is held between the fingers and brought directly over the rivet even though the rivet is not directly in line with the center of the hammer spindle. The punch is held directly on the work and rotated slowly by hand during the operation while the hammer moves up and down and the traveling bearing keeps the punch holder aligned vertically though the axis shifts laterally. Thus, the riveting point is fixed while the uneven wear on the anvil and punch holder head is continuously varied.

The housing is turned from a piece of cold-drawn steel, and the shank is threaded to fit the spindle of the high-speed hammer. The anvil is made separate so it can be replaced; it is press-fitted in the housing and a knockout is provided for easy removal.

Three radial screws tapped into the lower portion of the housing retain the traveling bearing, and the holes are spotfaced to provide gripping surface for the locknuts. The bottom face of the housing is hardened and polished.

The traveling bearing, also made of cold-drawn steel, is case-hardened and the ball race and the hole for the punch holder are polished to minimize friction.

Drillrod is used for the punch holder. The hammer end is hardened

and the punch end is left-hand threaded to receive the punch. The lower end is turned down enough before knurling so the finished knurls will be smaller than the body diameter. Otherwise the punch holder will not pass through the traveling bearing.

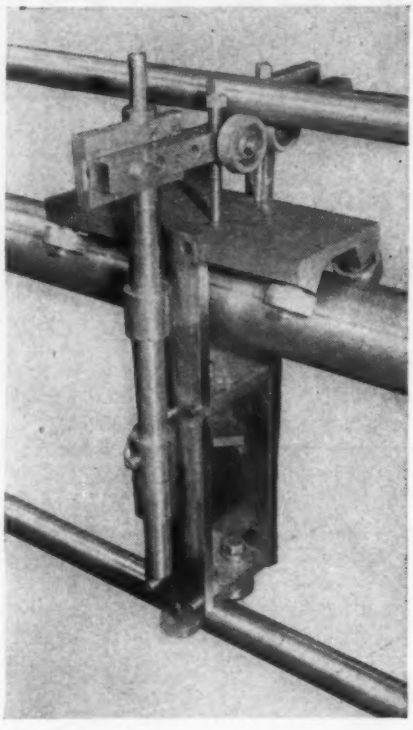
The vertical internal clearance, C, should be a little greater than the hammer stroke so the hammer can't lift the punch holder itself, and the external clearance, A, must be this much and should be more, to give plenty of room for the fingers in holding the knurled portion. Lateral clearance, B, the real purpose of the tool, can be as great as desired, but if it is increased a lot, the rest of the tool must be modified accordingly.

Improved Centerless Grinder Work Supports Shorten Setups

NICHOLAS E. WINLUND
U. S. Naval Shipyard, Puget Sound

Long shafts are now easier to centerless-grind with the aid of this attachment because the work is easier to align, and the roller carriages permit faster grinding.

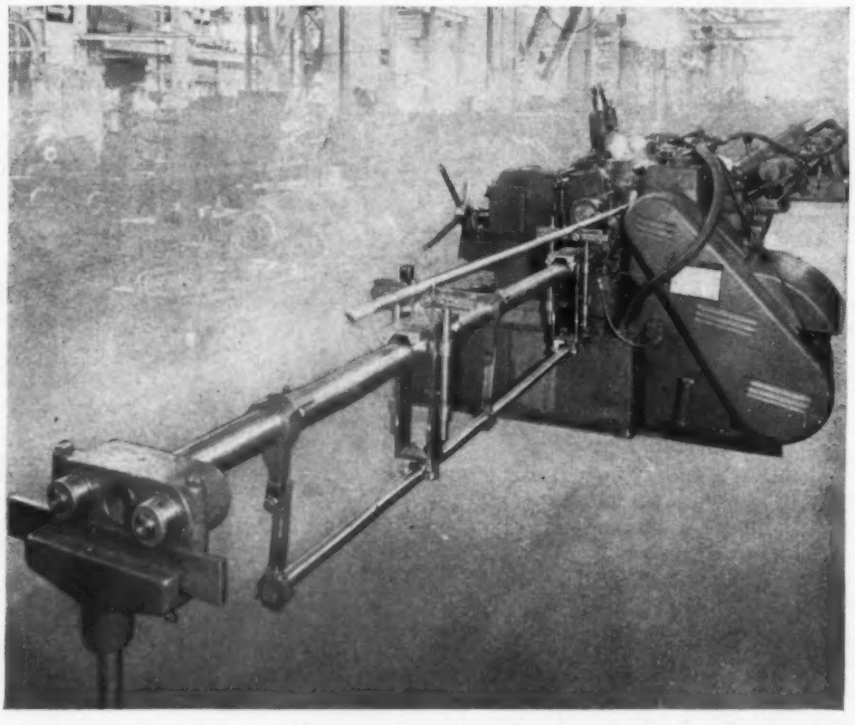
The support frame consists of a long tubular shaft extending from both ends of the grinder and held at each end with an adjustable vertical post. There is another, smaller shaft carried on three arms at a fixed distance below the main support shaft. The carriages rest on the main bar but are guided by the lower one.



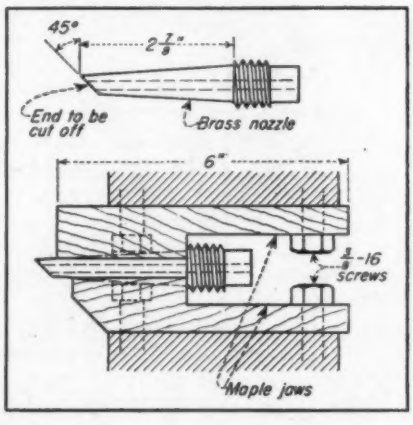
Closeup of carriage shows the eight rollers and hinged arm on the work roller

Each carriage has eight rollers. Six are axial, four on the main bar and two below, giving the carriage free movement along the supports. The other two are transverse, to permit the work to rotate in the grinding wheels easily. The six axial rollers are fixed; all linear adjustments have to be made on the bars themselves. The other two are adjustable in two directions, in and out, and up and down, and in addition, each is mounted on an arm which can be swung around quickly for rapid shifting of the carriage to clear collars or flanges on the work or to reposition the carriage after it has traveled the length of the support shaft.

To adjust, the procedure is to set the first or innermost carriage, then roll it out as far as it will go. The next carriage is then set to match the first.



Centerless grinder support bar consists of two horizontal parallel shafts and two roller carriages



Wood Vise Jaws Break Nozzle Bottleneck

D. BAKER
Boonton, N. J.

We just had a rush job consisting of beveling the ends of several hundred brass nozzles at a 45° angle. As the cost of a fixture to hold these pieces was high, and the work was not of a precision nature, we decided to fit jaws to a machine vise.

Two pieces of maple were prepared by drilling clearance holes for the ⅜—16 capscrews in line with holes already in the vise itself. The wood is cut away to clear the flange and threads on the nozzle, at one end and the holes are counterbored at the other end. The grip is tapered and gouged to an approximate fit.

Misaligned Two-stage Die Saved By Adjusting The Guides

S. FRAMURZ
Bombay, India

Even slight mistakes in the tool room usually mean the total rejection of a costly and complex die or workpiece. Before summary rejection of spoiled work, however, it is always worth investigating to see if some modification is not possible that could mend matters. Practice on this precept recently rewarded the writer with a valuable principle in die construction which, he believes, might prove of interest and profit to others.

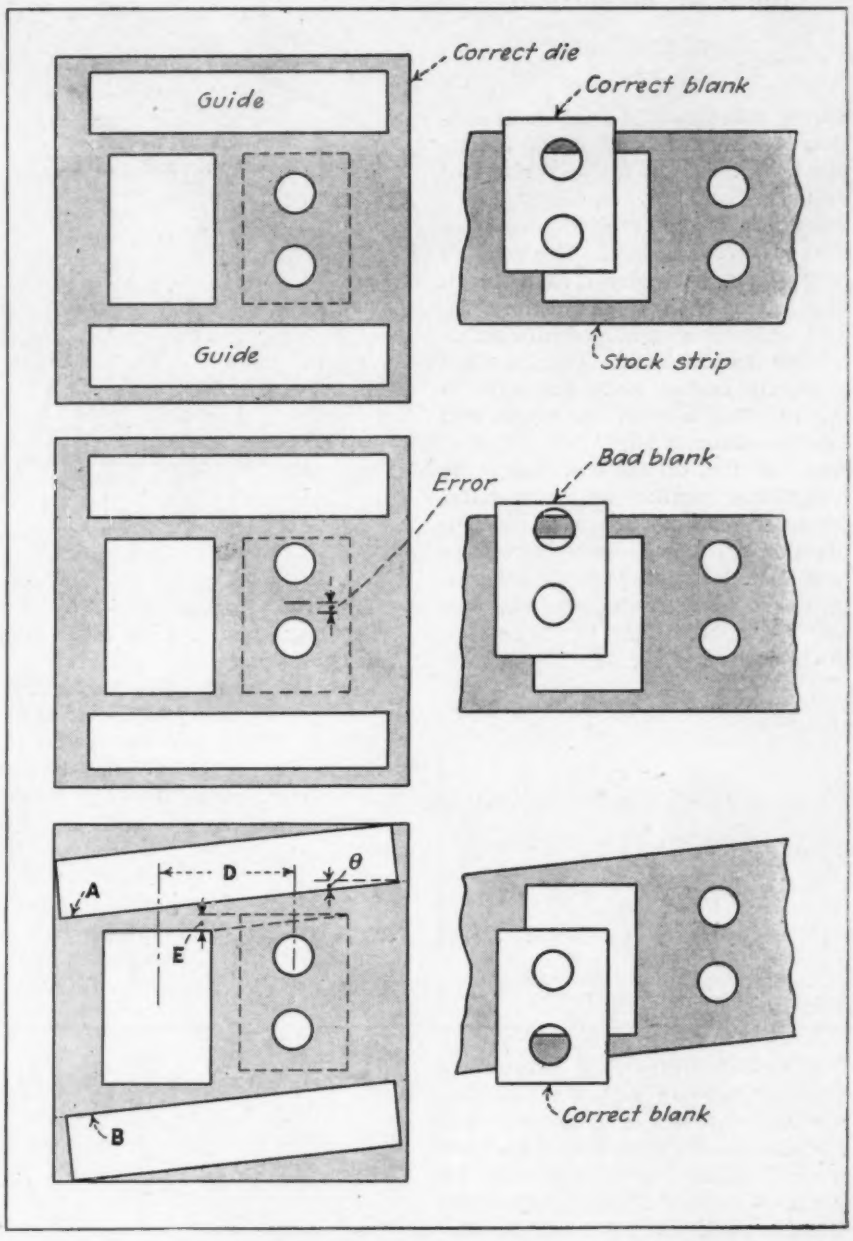
A two-station or follow die (for piercing and blanking combined) was to be constructed to produce blanks having two holes symmetrically placed with respect to both axes. After the die was almost complete it was discovered that, although the holes were correctly spaced relative to each other, the pair as a whole was vertically displaced with the result that the holes would not be centered in the blanks, rendering them quite useless for subsequent assembly.

After some thinking a remarkably simple remedy presented itself for the complete neutralization of the mistake. It consisted merely in introducing an equal displacement of the guide blocks (A) (B) so that, instead of being horizontal, their inner edges are set at an angle, θ. Of course, angle θ can be precisely determined because, if D is the "pitch" of the die (i.e. the distance between its piercing and blanking stations) and E is the vertical displacement of the piercing station with respect to the blanking station, E divided by D gives the tangent of the angle θ.

No matter how complicated the shape of the blank may be nor how numerous the holes or other shaped openings on the piercing station, if the error consists only in a vertical displacement of the piercing station, en masse, with relation to the blanking station, the formula indicated above would always apply and would effect a complete correction of the mistake.

If the displacement happens to be oblique, that is partly horizontal and partly vertical, only the vertical displacement should be considered when applying the correction because, as will be readily seen, the horizontal displacement, within limits, is not important, affecting as it does merely the width of metal left between adjacent blankings on the blanked stock.

The solution of this problem led to further thought on the matter of design of follow-dies in general. The angular or oblique principle may be found helpful in changing a basic design to save stock by laying out the work at an angle in the first place. It might happen that a large quantity of a certain size strip was on hand which was a little narrow for the work desired, in which case it would be worth investigating to see if modification of existing dies could adapt this stock, or if the designs could be changed, and new dies made to fit the stock. When a variety of work is handled, it is more economical all around to standardize on as few stock sizes as possible and make all dies to suit.

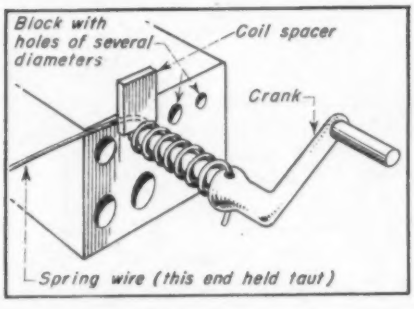


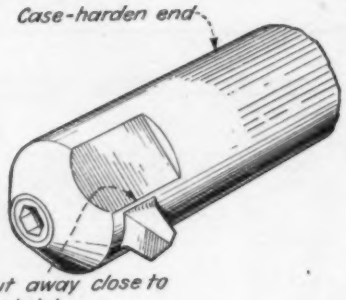
Left column, top to bottom: the die as designed; as built, showing the accidental error; as corrected by moving the guides at an angle. Right column: stock is punched in two stages. One blow of the punch makes two holes and blanks a rectangle. It is then fed distance D to the left and punch cuts a complete blank and two more holes

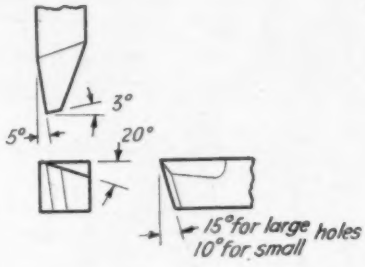
Hints on Small Tools

EARL R. GODDARD
Denver, Colorado

Spring Winder—The equipment consists of a metal block with an assortment of holes to make springs of various diameters, mandrels to fit the holes and a crank to attach to the selected mandrel. The coil of wire is placed where it will unroll in a line at right angles to the mandrel and provision is made for maintaining tension in the wire. To wind a tension spring, hook the wire in the rounded hole in the crank and start winding. A slight inward pressure on the crank will keep the turns close together as the mandrel forces it way out. To wind a compression spring, the same procedure is followed except that a spacer is provided between the first and second turns according to the spring pitch desired.

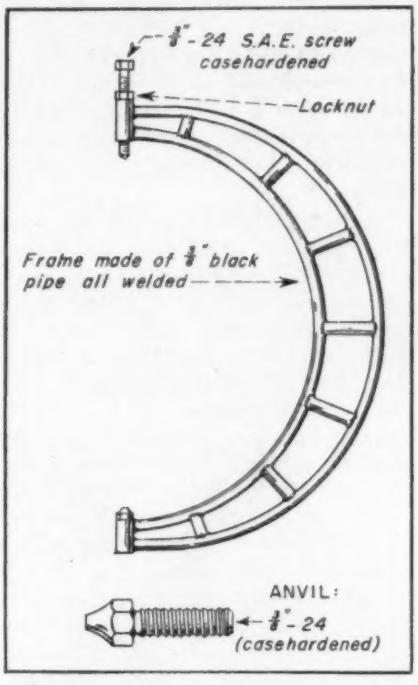




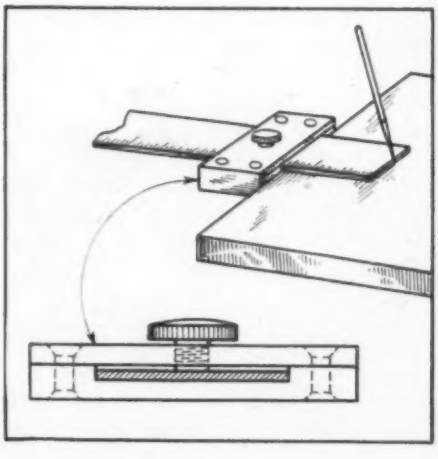


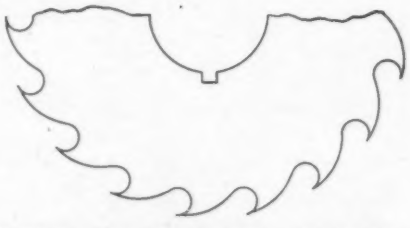
Improved Boring Bar—The ordinary boring bar usually has a generously oversize slot for the bit. When boring steel, chips may wedge in the opening and pile up. To minimize this, grind the bar away almost to the edge of hole with a tool inserted, caulk the edge to reduce the opening as much as possible. Case harden this end of the bar. A correctly ground tool helps too. This one will curl out a nice chip even on steel tubing and it does not chatter. Cutting in the bore on the last cut will help the finish.

30-in. calipers—With some large bushings to fit and no calipers available, we got busy and made our own. The adjusting screws are made slightly spherical to eliminate the necessity for making them square and parallel, and accurate settings are possible with the aid of an inside micrometer caliper. The C-frame is light but stiff and has proved much easier to use than a firm-joint caliper.



Depth Gage—Like the carpenter's marking gage in purpose, this simple head will slip over any standard machinist's scale to help in layout work. Nothing fancy is claimed for it except its ease of construction and handiness. Unlike the commercial flat depth gage head, this one will fit any scale. *S. Framurz.*



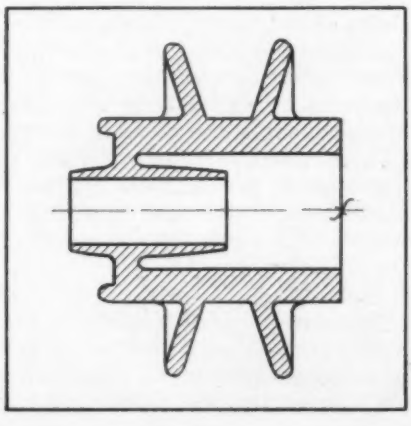


Milling Saw For Copper—Machinists who have had occasion to cut copper in the milling machine are familiar with the excessive heat generated in the process. It seems that the molecular construction of the metal is such that it offers high resistance to sudden bending.

We all know that if a lathe tool is ground with a generously curved top rake the tool will cut cleanly and without much heat. The same principle was applied here and the result was all that could be desired.

With this idea in mind, I also built up an end mill with set-in lathe toolbits, ground with this kind of a curve. *Lee L. Dodds.*

Fan Pulley Hubs—Assembled steel stampings for a high-production automobile engine are to be superseded by aluminum castings made in permanent molds. They not only reduce the cost of the overall job by several cents per unit but have improved the performance in two ways. Better grip and higher conductivity means less heat and cooler running. *Chester Ricker.*

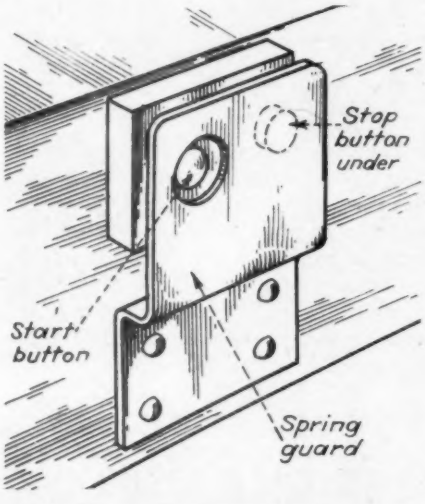


Positive Shut-off Improves Exposed Push-button Stations

HERMAN D. RIESAU
Naval Supply Depot
Spokane, Washington

Aluminum sheet cut and bent to cover the start-stop button on machine tools in many cases can remove the hazard of accidental motor starting when the control station is located where it might be struck by passing objects.

There is a hole over the start button large enough to reach through to start the machine, but should the plate be struck at any time, the stop button will be depressed. If, during operation, the operator should encounter trouble, he can strike the plate anywhere with his whole hand or any object he has handy; this is much easier than groping for the right button especially if there are more than two.



Aluminum spring guard protects machines from accidental starting and provides for emergency stops

The aluminum plate should be thick enough to resist light taps but be springy enough to deflect when you want it to. It can be secured with rivets or machine screws.

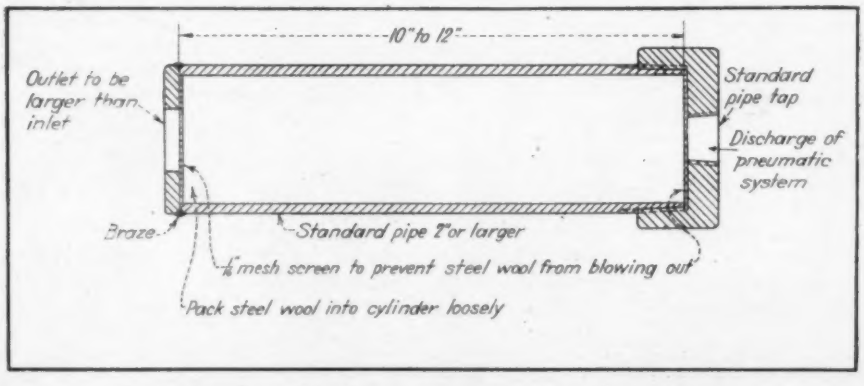
Pneumatic Discharge Muffler

W. F. BAGGOTT

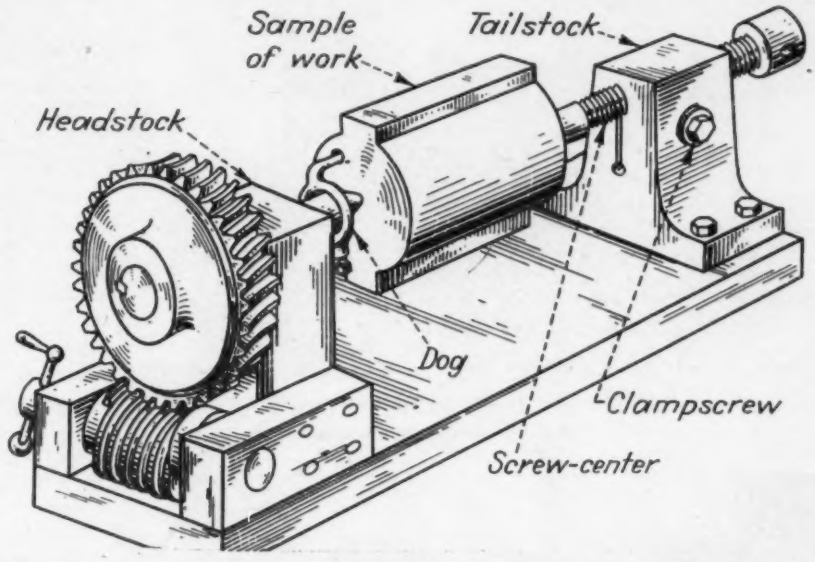
Where it is necessary to eliminate the noise of the discharge of a pneumatic circuit an adequate muffler may be provided at a low cost.

The material needed to construct the muffler is: one piece of 2-in. pipe 10 to 12 in. long, two pieces of 1/16-in. mesh screen, a steel washer, some steel wool or its equivalent, and a reducing fitting either standard or special.

The washer is brazed or welded to unthreaded end of the pipe, and one piece of screen is placed on the inside of the pipe over the hole in the washer. Steel wool is packed loosely in the pipe; the second piece of screen is placed over the end.


10" to 12"
Outlet to be larger than inlet
Standard pipe tap
Discharge of pneumatic system
Braze
Standard pipe 2" or larger
1/16 mesh screen to prevent steel wool from blowing out
Pack steel wool into cylinder loosely

Steel wool in 2-in. pipe muffles air exhausts



This punch is hand rotated while a shaper cuts its circular portion and the worm locks it in any position for straight feeds

Geared Centers For Shaper

Punches, splines and other partially cylindrical work can be effectively produced on a shaper with this fixture.

Many of the elements were made from odds and ends, in fact, the only new stock was the pair of gears and the screws and dowels.

The headstock spindle-center has a flange to take the axial thrust in operation and the worm wheel hub boss keeps the spindle in place. As the rotation is very slow, occasional oil can lubrication is sufficient.

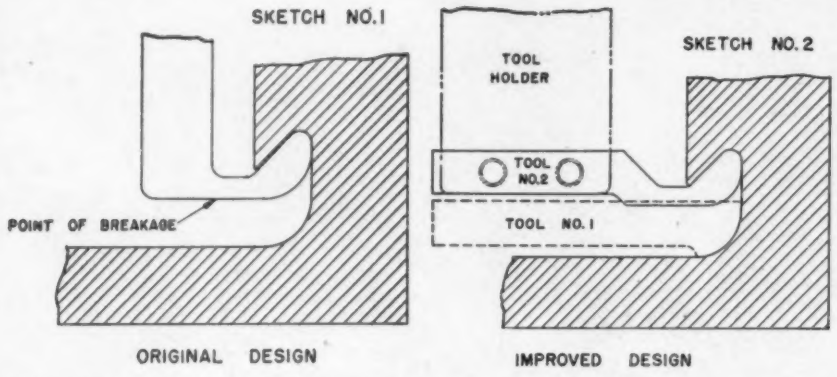
The tailstock center is a capscrew and it is locked by squeezing the slot together. *Author's name lost. Please communicate.*

Machining Oil Thrower Grooves

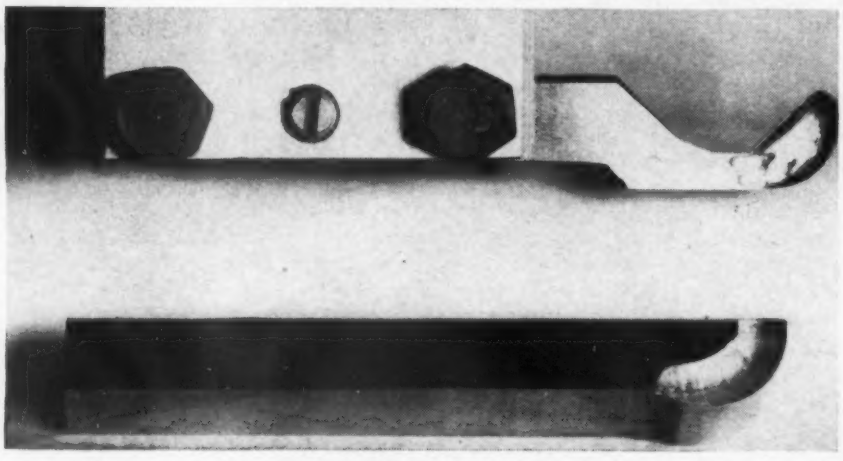
A. A. GOODMAN
Westinghouse Electric Corporation
South Philadelphia, Pa.

Machining the oil thrower grooves in coupling flanges of large gears presented a difficult tooling problem whereby lack of available space necessitated the design of a tool that proved to be too frail for productive use.

Sketch No. 1 shows graphically the machining work necessary and the tool originally designed for the



Vertical feed with this tool completed the groove in a single operation but the breakage rate was high



Now, the upper tool cuts the dovetail and then is replaced with the lower tool for the radius cut

application. Because this tool was forged, shaped, hardened and ground to size from one piece, its finished cost was quite high.

While of necessity cuts were small, as the tool had too much spring in it due to its thin neck, breakage in the neck area was exceptionally high during operation.

Below is shown a newly designed toolholder and the two tools specifically designed to overcome this problem. Only one toolholder is required for all the various sizes of oil thrower groove machines, but a pair of cutting tools must be available for each size groove. A pair of standard ⅝-in. toolbits are jig-ground to suit the upper and lower contours of the groove. Sketch No. 2 shows how the two tools fit the contour of the groove.

The rigidity of these tools eliminated breakage; the absence of tool chatter results in better finishes; and, heavier cuts make faster machining possible.

Previously, the average tool wear was one broken tool per groove cut; with the new setup, 18 grooves were cut and finished before it was necessary to regrind either tool, and furthermore, no tools were broken. All grooves of this type are now cut by similar two-piece tools, resulting in better and cheaper tooling.

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Fifteenth Selection—S. C. Carty's Valve Seat Repair

Master Gear Standard—I

THE AMERICAN GEAR Manufacturers Association has issued tentative Standard 235.01 entitled "Gear Inspection and Tolerances, Section 5—Master Gears." This standard applies to gears of the following types:

Spur and helical gears, up to 12-in. diam. and 2-in. face, 3 to 16 DP
Worms and worm gears
Straight, spiral, and zerol bevel gears
Hypoid gears

Definitions

A master gear is one of known accuracy in every respect. It is usually hardened and ground, and by measurement proved to be highly accurate with respect to runout, pitch error, accumulated error, profile error, and lead or spiral-angle error.

Master gears are used primarily on gear-rolling fixtures for a running check of gears to determine the cumulative effect of errors in individual elements, and provide the means of determining whether these errors compensate for each other or build up in excess of specifications. They determine backlash, runout and smoothness of operation.

Backlash may or may not be provided in a master gear. When it is, a master is usually sized for the average backlash desired.

A green master gear is one that is used to check green gears. It may purposely be made off standard with respect to pitch, profile, lead or spiral angle, or tooth thickness, to match production gears made off-standard to allow for changes during heat-treatment. Such gears are hardened and ground.

Thin-tooth master gears are a type of green master gear commonly utilized in the production of hardened and ground spiral and zerol bevel, and hypoid gears. The teeth, being thinner by the amount of grinding stock allowed in the mating production gears, permit meshing with the green production gear on a testing machine at proper relation, in order to control grinding stock, as well as tooth contact.

A sample gear is one that is identical with the production gears, which is retained for control or reference purposes. Such gears are hardened and ground only if the production gears are likewise hardened and ground.

A control gear is similar to a sample gear except that the number of teeth is different. It is also used for control or for reference purposes. Control gears are not applicable to worm and bevel gearing.

Spur and Helical Gears

This standard is based on the use of master gears in variable-center-distance devices. Fixed-center-distance fixtures are not recommended because of the expense of making the necessary master gears to the extreme accuracy of both runout and size over pins.

The accompanying table lists Classes 1, 2, and 3, differing in the amount of runout. The two latter classes are held successively closer and, therefore, are more costly to produce. For all classes a liberal tolerance of gear-tooth measurement over pins is permissible, provided the O.D. is adjusted accordingly. Spur and helical master gears are usually hardened and ground. The tooth thickness is determined by measurement over pins, as in the AGMA Standard "Gear-Tooth Measurement over Pins."

(*Continued on a following page*)

Spur and Helical Ground Master Gear Tolerances

All dimensions in inches

	ALL CLASSES		
Hole size within	+0.0002		
(Preferred hole sizes ¾, 1-¼, 1-¾)	—0.0000		
Face runout of locating suraces with respect to hole, total indicator reading per in. of diam., not to exceed	0.0001		
Outside diameter size within	±0.0010		
Runout of outside diameter, with respect to hole	0.0010		
	CLASS		
Runout (as measured by pin, cone, or ball)	**1**	**2**	**3**
4 diameter and smaller	0.0005	0.0004	0.0003
4+ to 8 diameter	0.0009	0.0007	0.0005
8+ to 12 diameter	0.0013	0.0010	0.0007
	ALL CLASSES		
Gear-tooth measurement over pins	+0.020		
(See footnote 1)	—0.000		
Pitch error (tooth-to-tooth variation, not over pins)			
4 diameter and smaller	0.0002		
4+ to 8 diameter	0.0003		
8+ to 12 diameter	0.0004		
	SPUR	**HELICAL**	
Profile error (total variation, not plus and minus)			
4 diameter and smaller	0.0002	0.0003	
4+ to 8 diameter	0.00025	0.00035	
8+ to 12 diameter	0.0003	0.0004	
	ALL CLASSES		
Circumferential lead error per in. of face (or parallelism of spur teeth with axis)	0.0002		

1. Circular tooth thickness at standard pitch diameter to be marked on each master gear.
2. Tolerances for root diameter are purposely omitted because they affect only the clearance at the root of the teeth, and therefore are considered unessential.
3. Material recommended is high-speed steel hardened to a minimum of Rockwell C63.
4. The tolerances suggested in this table are to be considered binding on a manufacturer or seller only when specifically agreed to in writing.

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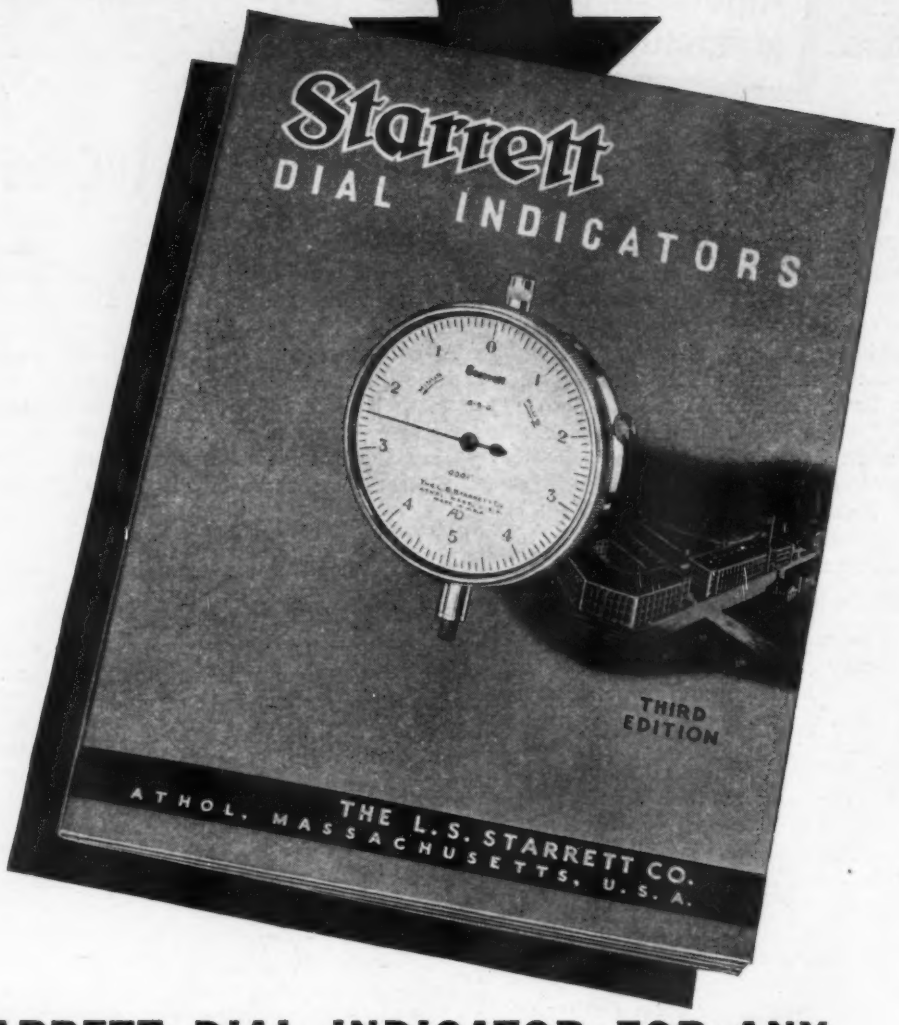

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Master Gear Standard—II

Worms and Worm Gears

Master worms are usually hardened and ground. Tooth thickness may be readily controlled.

Sample worms are purposely made to match worm gears produced by a particular hob, with respect to tooth profile and lead. Master worm gears are not hardened and ground. Often the first worm-and-gear set from a lot is properly matched and then retained as a sample set.

Straight, Spiral and Zerol Bevel Gears; Hypoid Gears

Master straight bevel gears are not hardened and ground, but may be hardened after cutting teeth.

Master spiral and zerol bevel, and master hypoid gears are frequently hardened and ground.

Green master gears, thin-tooth master gears, and sample gears are commonly used for bevel gearing.

For definitions of various gear errors and methods of measurement, refer to Sections 1, 2, 3, 4 of "Gear Inspection and Tolerances."

Tolerances for spur and helical master gears are shown in table.

Tolerances for worms and worm gears, straight, spiral and zerol bevel gears, and hypoid gears, are 75% of the most accurate classes listed in Sections, 1, 2, 3. The desired backlash must be stipulated in each case.

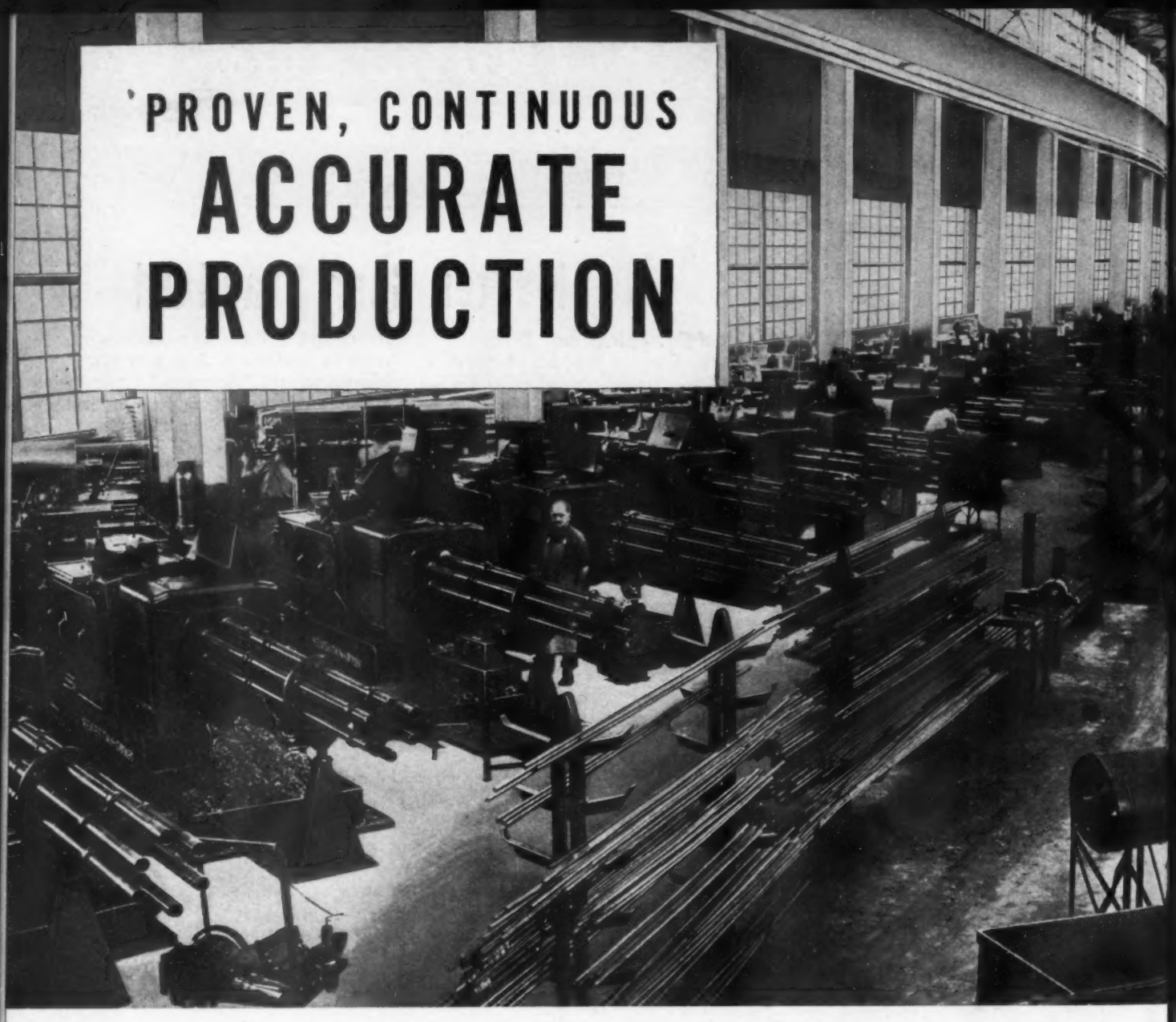
SAFE SPEEDS AND FEEDS FOR HIGH-SPEED STEEL DRILLS*

COURTESY CHICAGO-LATROBE TWIST DRILL WORKS

Drill Size In.	Aluminum and Copper		Cast Iron		Brass or Bronze		Steel Cstgs, Monel Metal, Stainless Steel, Molybdenum Drop-Forged Tool Steel		Drop Forgings, Alloy Steel Heat-Treated, Also SAE 4140		Mild Steel		3½% Nickel Steel Castings	
	Feed	Speed	Feed	Speed	Feed	Speed	Feed	Speed	Feed	Speed	Feed	Speed	Feed	Speed
1/16	.002 to .005	15000 to 18000	.002 to .004	4575 to 6700	.002 to .004	9150 to 12000	.002 to .003	3650 to 4550	.002 to .003	2750 to 3650	.002 to .003	4275 to 5500	.002 to .003	3650 to 4550
1/8	.002 to .003	7600 to 9100	.002 to .004	2300 to 3350	.002 to .004	4575 to 6100	.002 to .003	1800 to 2250	.002 to .003	1375 to 1800	.002 to .003	2100 to 2800	.002 to .003	1800 to 2250
1/4	.003 to .005	3800 to 4600	.004 to .006	1150 to 1675	.004 to .007	2300 to 3000	.003 to .004	925 to 1150	.003 to .004	700 to 900	.003 to .005	1050 to 1375	.003 to .005	925 to 1150
3/8	.003 to .005	2500 to 3000	.006 to .009	750 to 1125	.007 to .010	1525 to 2025	.004 to .006	600 to 750	.004 to .005	450 to 600	.005 to .007	700 to 925	.004 to .006	600 to 750
1/2	.006 to .008	1900 to 2280	.008 to .012	575 to 850	.010 to 0.014	1150 to 1525	.006 to .009	450 to 575	.005 to .006	350 to 450	.006 to .010	525 to 700	.006 to .010	450 to 575
5/8	.008 to .010	1500 to 1800	.012 to .016	450 to 675	.014 to .018	900 to 1200	.008 to .012	350 to 450	.007 to .010	275 to 375	.010 to .014	425 to 550	.010 to .014	350 to 450
3/4	.008 to .010	1250 to 1500	.012 to .016	375 to 550	.014 to .018	750 to 1000	.008 to .012	300 to 375	.007 to .010	225 to 300	.010 to .014	350 to 450	.010 to .014	300 to 375
7/8	.010 to .013	1095 to 1300	.014 to .020	325 to 475	.016 to .022	650 to 875	.010 to .014	260 to 325	.009 to .012	180 to 250	.014 to .016	300 to 400	.014 to .016	250 to 325
1	.010 to .013	950 to 1125	.014 to .020	280 to 425	.016 to .022	575 to 750	.010 to .014	225 to 280	.009 to .012	150 to 200	.014 to .016	265 to 340	.014 to .016	225 to 280

These feeds and speeds are recommended for average working conditions and materials, and may be increased or decreased according to conditions. Coolant should be used liberally. Don't let drills run too long, keep them sharp, to get longer life and more holes per drill.

PROVEN, CONTINUOUS ACCURATE PRODUCTION

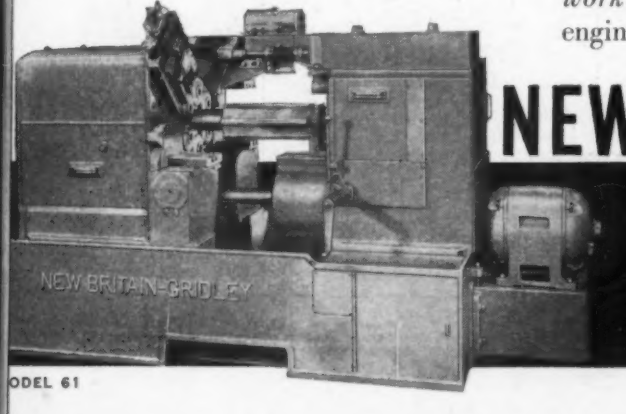


The ability to make parts faster, with continuous accuracy, has been proved by New Britain Multiple Spindle Automatic Screw and Chucking Machines during the war, before the war, and it is becoming a byword in today's peacetime production.

This is not an idle statement. It is backed by the way New Britains are built to continue to give original accuracy for years of production with a minimum amount of down time.

Elimination of slow methods, extra machines, extra handling, is the realistic approach to maintaining profitable production. Again and again New Britain Multiple Spindle Automatic Screw Machines and Chucking Machines *plus* New Britain engineering make this practical. Have you discussed *your work* with the New Britain sales engineer in your locality?

For more, better parts per hour, at lower cost, this year and years from now, *it pays to pick New Britain*



ODEL 61

NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

M-0104

NEWS OF METALWORKING

Current Output Levels in Chicago Expected to Hold Until Next Year

CHICAGO—Production in Chicago area metalworking plants has been on a plateau since the middle of the year, and production executives see little hope of an improved output rate until sometime next year. While the level of production is well above prewar, it is between 10 and 20% lower than an adequate supply of materials and manpower would allow.

Generally, plant managers are resigned to current output levels. They could be raised by addition of extra shifts or by some other emergency measures, but the consensus is that such moves would cost more than they are worth. In addition, the belief is spreading that even at present rates of production, supply and demand forces in many types of goods will be in balance by next Spring. In that case, firms see little purpose in struggling to raise output a few points now only to have to cut it back in another six months.

E. J. Bush, president of Diamond T Motor Car Co., for example, said production has been at a fairly good rate despite a tight materials supply picture. Rather than expecting improved output in the immediate future, he said the company would do well to maintain current levels. Production now is about as high, he said, as can be expected considering the supply of materials available. Until some metal-using activities recede, or until new facilities for providing raw materials are put in operation, he pointed out, output of durable consumer items cannot be expected to increase much.

Third Shifts Unlikely

J. H. Collier, chairman of the board of Crane Co., is of a similar mind. Crane, he said, is planning to keep output on current levels in the next few months, except in the unlikely eventuality that the company should add third shifts in some operations. In some types of plumbing and heating equipment, output is expected to match demand by Spring, although there certainly will not be an end to the building materials shortage, he declared.

International Harvester spokesmen asserted that in some lines—such as motor trucks, combines and corn pickers—the production outlook in the next few months is gloomier than at present. Ordinary farm machinery, on the other hand, is expected to maintain present levels or improve slightly. The dividing line will be the sheet steel supply—items that need little sheet steel may be turned out in greater quantity. Output of motor trucks, tractors, and refrigeration is also suffering from a lack of copper.

Buda Co. also foresees no improvement in the production level in the next few months. Production schedules have been levelled off for several months now.

Balanced Inventories Seen

An exception to the general belief that output cannot increase greatly is General American Transportation Co. Officials expect output to climb as more full complements of materials become available, and as unbalanced inventory situations are straightened out. The company expects materials to accumulate in better proportion to each other in the next few months.

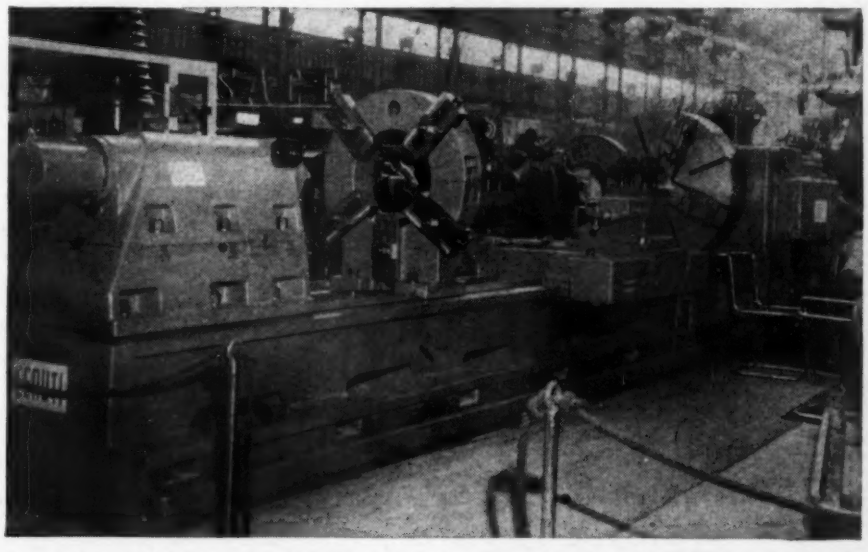
Meanwhile business activity and factory payrolls continue to climb in the Chicago area, and signs of a downturn are still lacking. In Illinois, employment in manufacturing plants is at the highest level since the end of the war, and payrolls in durable goods industries are climbing faster than in nondurable goods plants. Average weekly earnings are also climbing. In Chicago the employee index is up to 130.5 compared with 111.5 a year ago.

Freight Shipment Delays Hamper Buffalo Production

BUFFALO—Metalworking plants in the Niagara Frontier are suffering production cutbacks because of delays in handling by some railroads of less-than-carload shipments which have swamped freight stations here.

Railroad officials ascribe delays to high labor turnover and shortage of experienced help; a sharp rise in less-than-carload shipments, estimated at 24 to 50% above normal and caused in part by limited production and efforts of manufacturers to distribute goods evenly in small lots.

One of the largest steel companies in the area reports deliveries of less-than-carload freight have been delayed as much as a week or 10 days. It has a definite influence on receipt of replacements for down machinery. Time lags of three weeks to a month from the time material leaves the shipper until it arrives at its destination have been reported.



Recently exhibited Italian Lathe—An example of modern European metalworking equipment is this Geruti lathe, on exhibit at the Italian Industrial Fair, Milan. This is one of the machine tools being used by the Fiat Company in the construction of marine engines

Gaging Business

Stabilizing Production

Metalworking companies are showing a growing tendency to reschedule production downward on a realistic basis to conform to the amount of materials, component parts and manpower available. This trend is especially pronounced in the automobile industry. Individual car makers have pulled down their daily rate so that they can operate from now on without interruption, barring labor trouble, and thereby achieve lower costs. Heretofore they have attempted to run at a higher level and have been forced to suspend production intermittently as shortages arose.

This trend, along with the policy of most manufacturers to get their inventories down in line with the flow of their shortest item, is a healthy development and will make for sounder industrial operations. It may seem to bring about a somewhat lower operating rate, but on the whole the economy will benefit. Though shortages of other materials are serious, it appears at the moment that the ability of many metalworking companies to attain their 1947 production goals will depend on the tonnage of steel at hand. In the case of sheet mills making sheets 76 in. and wider, tonnage will be stepped up considerably the next few months as new crews become better trained and scrap losses shrink.

Equipment Builders Busy

Many lines of metalworking are running at or near peak levels. Textile machinery makers, for example, have backlogs which cannot be worked off in less than two or three years. Builders of mechanical and hydraulic presses report that they are making little if any progress in whittling down the size of their accumulated orders, despite capacity operations and despite farming out a lot of work. Plastic molding equipment manufacturers still are as busy as ever with no indications of a decrease in volume ahead. Package machinery builders are so heavily engaged that they are asking for outside help. The gearing industry, by contrast, had a decline in volume of new orders of 7.1% in September compared with August, but production continues at a very high rate.

Tool Business Spotty

New business booked by the machine tool industry has been spotty, in some instances showing a pick-up and in others registering a drop-off. Most companies are doing very well compared with prewar volume, but production is hampered by various shortages, particularly of electrical apparatus. It is not unusual for builders to have on their floors machines which are finished except for electrical equipment that will not be available for as long as three months. Orders are coming from a wider variety of sources than in some time.

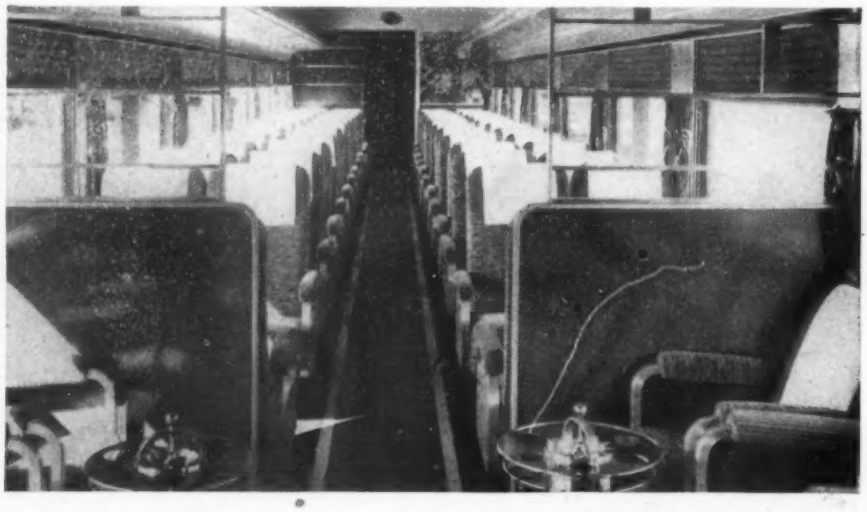
Office equipment companies have actively entered the machine tool market for replacement and expansion equipment. One interesting aspect of this development is that the industry is apparently seeking to increase the relative ratio of new, precision equipment in its plants to help turn out accurate parts for modern types of office equipment. This is an encouraging development, since the AMERICAN MACHINIST 1945 survey indicated that manufacturers of business machines had over 62% of their equipment in the over-10-years-old category, as against an average of 38% for all metalworking industries.

It now appears that the industry has found used equipment and selections from surplus inventories inadequate to meet greater precision standards of modern office equipment parts.

Pig Iron Output Rising.

One reason behind the ability of the steel industry to hit new operating peak levels despite a continued tightness in the scrap supply has been the rising levels of pig iron production. Steel companies are striving hard to put as many blast furnaces back into operation, and have shown greater activity in purchasing surplus government-owned blast furnaces. Many of the government units seemed surplus to the companies themselves months ago, but the scrap situation and the continued heavy demand for merchant iron assures profitable operation of many of the wartime giant furnaces.

October iron output is estimated to have exceeded the August high level of 4,898,000 net tons, and showed a good recovery from September's 4,687,000 ton output. Necessary repairs and the short month accounted for the slight decline in the September total. Even so, operations in both months were only around 85% of total national capacity. With the resumed operations of blast furnaces at Geneva, the East Chicago government unit taken over by Inland Steel, and several other furnaces, pig iron production should show a large increase over the remaining months of the year. This will be good news to the thousands of users of iron castings, who have been hard pressed by the competition for merchant iron forthcoming from the housing and farm equipment programs.



New Streamlined Passenger Car—Luxurious transportation at coach rates will be available with the operation of four new postwar streamliners by Louisville & Nashville Railroad, made by American Car & Foundry Co. Aside from their attractive interior, the cars will have individual non-glare lighting systems, individual heating units, and will weigh some 10,000 lbs. less than standard cars

Railroads Eye Industrial Trends As Check on Replacement Program

WASHINGTON—Continuation and addition to the car replacement program of American railroads, now running over wartime but considerably under pre-war figures, hinges for the most part on what happens to industrial production and earnings. The railroads, always sensitive to the nation's economic trends, are not going overboard in a car replacement program when the economy is nearing a touch-and-go state.

In Washington, economic crystal gazers are predicting an initial downward slant in the curve of industrial earnings, then a leveling-off which ostensibly will continue until 1950. The prognosticators have made a backward revision on their estimates on when the curve will start downward, from next fall to next spring, but have failed to make a satisfactory guess on the extent of the "recession."

Shortages Hamper Backlogs

This is just one reason why the railroads are not giving full throttle to new car orders. Another, and related reason is that materials shortages are still hampering new car production, and the roads feel it is poor policy to build up a huge backlog of orders for rolling stock they might not see for several years.

However at the present time the railroads have approximately 61,600 freight cars on order, an increase of 10% over the September backlog and almost twice the figure last year at this time. The order backlog will continue at about the present level until either a "recession" does appear or until the roads find orders have reached and exceeded retirements of old and war-weary stock. This latter contingency is some years away.

Wartime traffic called back into circulation a large block of old cars that had been retired. These veterans are now being put back on the junking tracks as they outlive their reconditioned usefulness.

Demand Near Maximum

This year approximately 58,000 old cars will be retired to the scrap heap, about 10,000 less than in 1938-39 and 5,000 under the 1940 figure. The present trend in retirements should remain at about the present level until early next year, when demand for cars will return to a seasonal middle ground and allow the weeding-out of uneconomical cars to go on. The demand curve now is near the maximum and backlogs in orders are building up throughout the country, which should continue the near-peak loadings until Christmas time, an unusual occurrence. Ordinarily the peak in loadings is reached in early October, then drops sharply in November and December. There will be a downward trend from now on until the end of the year, but not in as precipitate a fashion as heretofore.

Lincoln Foundation Announces $200,000 Design Award Program

CLEVELAND—A $200,000 design-for-progress award program is being sponsored by The Lincoln Arc Welding Foundation for engineers, designers, architects, draftsmen, production and maintenance officials, researchers, educators, and welding shop owners and workers.

Cash awards ranging from $100 to $13,200 will be made for papers or reports covering the design or redesign of machines or structures, or operating a job weldery, or maintenance service, or on research or education.

Government Aid Held Necessary For Dispersal of Key Industries

WASHINGTON—Government aid in dispersing American industry under a pre-conceived military pattern is foreseen by Richard R. Deupree, president of Procter and Gamble, and chairman of the Army-Navy Munitions Board. Industry, left to its own devices, is following the right track in decentralization but the move is too slow to prove of immediate military value.

"We can see that any speed-up in the right direction would have to be engineered with government help," Mr. Deupree said. "Just how much this would cost is not known—but it is an astronomical figure."

Tactical dispersal, so key industries could not be crippled or wiped out by one well-plotted concentration of weapons, is one of the greatest problems confronting the board. Logically, an over-all plan for industrial mobilization must be devised and put into final form before further action is taken. The plan is now taking shape, including the writing of a manual on the future mobilization structure.

Nelson Wants Action

Mr. Deupree indicated the board is not considering any suggested legislation for the next session of Congress. He could not estimate when such proposed legislation would be ready for submission. This delay in preparing plans does not mesh with the views of outsiders, including Donald Nelson, ex-WPB head, who feel the program should be initiated immediately. President Truman is being urged to get legislation before the next Congress.

Mr. Deupree is in favor of further action by the next Congress to increase the allowable expenditures by the military for stockpiling of critical materials. Appropriations are set at 100 millions for this year. He believes this should be about 360 millions a year for the next five years or so. During this critical period of materials shortages, the Board is going ahead with its buying program cautiously, staying out of crowded markets as much as possible.

Standardization Savings

The recent Presidential order giving him final authority in designating joint procurement responsibility between the Army and Navy is not, in Mr. Deupree's words, a move toward military unification. The order, which gives the board chairman the power of final decision in case of a controversy over service procurement, will have a decided effect in standardization of many like items now bought individually by the two services.

Standardization in procurement of many items common to both services will mean a large saving in expenditures and in acquisition time, Mr. Deupree said.

The chairman emphasized that the Board is not a purchasing agency, nor a weapon development group, but is actually a coordinating agency between the two services on mutual problems, and a high echelon planning panel for preparedness in any future emergency.

Survey Indicates Broad Demand For Porcelain-Enamel Products

FRENCH LICK, IND.—Porcelain enamel is preferred by most consumers for kitchen equipment, according to a survey report made at the annual meeting of the Porcelain Enamel Institute.

Tightness Continues in Most Steel Products; Few Price Increases Seen

PITTSBURGH—The leading producer of light flat rolled steel products has sent out its quotas of tonnages for the first quarter of 1947. They do not differ in any fundamental respect from those which have been in existence during the fourth quarter of this year, which means the sheet situation stays tight.

Opinions have not changed that a slightly easier trend may become evident before the end of the first half of 1947. This, however, is emphatically predicated on a continuation of the recent level of production which means no interruptions over the next few months due to strikes. In this regard, what may develop in respect to the wage negotiations with the United Steel Workers in January is a question.

1947 Books Open

Books generally have been opened for the first quarter on bars, with mills soon booked on hot carbon bars. Orders for cold-drawn bars were a little slower to come to the plants.

Business is moderate in alloy sheets and alloy bars in larger sizes. An order book in electric steel products which is none too heavy in these two particular items, plus some shortages of scrap, continue to account for the moderate production activity in electric furnace steel.

Plate mills are substantially booked through the first half of 1947. Export demand is heavy in this product and domestic requirements come from a wide assortment of users. Production of plates depends in an important way on raw steel allocations to such mills, as some other products get preference.

Structural Demand Down

The trend in structural demand is downward, because of restrictions on building. The ability to produce shapes is the same as in plates. There is a good backlog of shape orders and mills are under pressure to make deliveries against contracts.

Output of reinforcing bars is limited in the face of widespread demand. This is an item on which the mills claim there is a loss and incentive to produce is lacking.

Nail production is going up as a result of premium payments by the government. Pipe mills are clogged with business.

Price Decontrol

The decontrol move is chief topic in the industry. There is no question that some items, particularly those in which mills claim there is a loss (galvanized sheet is an example), will rise in price. Overall, there is an industry opinion that after perhaps some preliminary excitement and fluctuations prices will settle somewhere close to the current average. This average most likely will be slightly higher than at present. No one expects it will be lower.

Many mill managements are thinking of competition which most expect to be more evident during the second half of 1947. Their third quarter earnings reports made good reading, and included a new high for a quarter for all time by National Steel Corporation. A number of steel executives were quick to point out, however, that their break-even point has been rising steadily, and that the consistently high level of production during the third quarter was the main factor in obtaining favorable profit results.

Elected to U. S. Senate

Ralph Flanders

Ralph E. Flanders, chairman Jones & Lamson Machine Co., Springfield, Vt., was elected by a 3-to-1 majority as United States Senator from Vermont on Nov. 5. He has long been a leader in the machine tool industry and recently was president of the Federal Reserve Bank of Boston. He served as president of the National Machine Tool Builders Association in 1924 and later became active in the public works program of the American Engineering Council and was a member of the Council's Committee on Government Reorganization. He has continued his interest in government operations and has been called upon to serve in an advisory capacity.

Price Decontrol Expected to Result in Moderate Increases, Some Adjustments

WASHINGTON—Moderately higher price levels for industrial materials, parts, and equipment were expected as a result of the lifting of government price controls on Nov. 11. Such increases would largely replace government subsidies on nonferrous metal imports, high-cost blast furnaces, and such, aside from the boosts that are necessary to rectify uneven margins previously afforded by OPA price ceilings. In any event, informed observers do not see any excessive increases in industrial prices, especially since wage controls have also been lifted simultaneously with price controls and many new labor contracts are due for renegotiation in coming months.

The elimination of price controls will permit rectification of distorted margins on various steel products, industrial equipment, castings, and so on, which have curtailed or entirely eliminated the output of some items. This means OPA prices will cease to be a reason for shortages.

Motor Prices Up

Executives of the electrical equipment industry indicated that electric motor prices would go up. This means an upward adjustment in prices of all types of industrial and consumer equipment requiring motors. On the other hand, no general increase in steel prices was expected by industry observers, although some adjustments of levels for reinforcing bars, wire products, and a few other shapes was being effected. This meant that users of such steel products would get a better share of total steel output.

SPI Discusses Shortages

MANCHESTER, VT.—Shortage of plastics materials highlighted a report here to the Society of the Plastics Industry, made by the Plastic Materials Manufacturers Assn. Manufacturers reported that demand is running at around three times the available supply, even though the output of molding plastics is double the 1941 rate and 40% above the 1945 rate.

The situation was laid to shortages of raw materials, and interference of strikes and government restrictions on construction of new plants to expand the supply of basic chemicals needed in plastics production. Stewart Landes, Celanese Plastics Corp., said the number of molding and extrusion presses on order for plastics-consuming industries indicated that the spread between demand and supply will continue to increase.

At present, plastics material manufacturers are engaged upon a $147,000 expansion program, but completion of these projects is being deferred by various factors.

Detroit Letter

Tool Buying Ahead

Here and there can be seen the first trickles of the ordering for 1948 automobile tooling requirements. But the real buying is as yet to come. Present timetable indications are that the February-March period will see the bulk of the releases leave the desks of the passenger car purchasing agents.

Present plans call for fairly substantial changes in the 1948's. Body lines will be largely revamped, indicating substantial die ordering. At least one company—now in the first stages of beginning to build a stockpile of motors—plans a complete new powerplant. Major modifications in other motors also seem indicated. Automatic transmission use is scheduled for enlargement, which means more tooling.

All, however, is not serene and cheerful. From all indications, as example, Ford has not yet decided on the automatic transmission it will use for its Lincoln and Mercury cars, and, as a result, a substantial amount of machine tool purchasing has been held up. Too, a vague rumor is floating around—as yet without apparent foundation—that General Motors is going to delay, in one full sweep, the major modifications it planned for its 1948 models until the 1949's come onto the scene.

Prices A Worry

Some Detroit machine tool makers, meanwhile, are worried over reports of price reductions by outside competitors who have the advantage of being in lower wage areas. There is no trend in this direction as yet, but first faint murmurings of the sort always have the potential of magnifying rather quickly.

Right in Detroit, meanwhile, Superdraulic Corp., a subsidiary of Hydraulic Machinery, Inc., has cut prices on its hydraulic pumps and other products an average of 20% due to increased production and reduced manufacturing costs.

There is no gainsaying the fact that tooling costs have the car makers badly worried. Purchasing agents feel that the higher prices (whose reasons they know full well) not only are problemsome in themselves, but they are concerned also with the fact that in the forward period the opportunity of amortizing those costs over volume runs may be handicapped by labor and materials uncertainty. Costs of machines and tools for them have seldom been discussed as much in top management circles of the auto companies as in the recent past.

Inquiries Rising

Kaiser-Frazer Corp., which is planning bigger and bigger things for its car making operations, has numerous inquiries out for tooling of all sorts, including machines and presses. Also making inquiries is the Tucker Corp., which continues to clutch at least a toehold on the erstwhile Dodge-Chicago plant, despite moves in Washington to transfer the facility to a prefabricated house maker.

No cancellations of consequence have been noted among principal suppliers in recent weeks, not since the Ford and Chevrolet light car programs were delayed indefinitely. (The Chevrolet program, incidentally, will be up for reconsideration by the G. M. board early in the spring.) There have been some instances of orders to hold up scheduled deliveries until later dates, but these are not regarded as cancellations.

Ford Reorganization

The Ford engineering department has been completely revamped since H. T. Youngren was made vice president and director of engineering. The new department, well infused with outside blood, is formalized into an organizational setup of the sort being arranged in all the major operating divisions at the Rouge.

Under Youngren are seven departments: Commercial vehicle engineering, headed by chief engineer Dale Roeder; electrical engineering, under chief L. L. Beltz; Lincoln and Mercury car engineering, under chief H. H. Gilbert; Ford passenger car engineering, under chief H. S. Currier; research, under director W. S. James; styling, under director E. T. Gregorie; and engineering testing, under chief A. W. Frehse. Business operations of the department are under V. Y. Tallberg, administrative engineer. Personnel, and patent and legal sections are attached.

Youngren and Currier are former Olds men; Frehse came from Chevrolet; and Gilbert from Cadillac. James is a Studebaker alumnus. The others are Ford veterans.

In charge of Ford engine design, development and production refinement is another newcomer, Harry G. Smith, formerly in a similar post at Buick.

Ford Cutting Costs

Ford's energized purchasing department, meanwhile, has been engaged in a broad program of cost-cutting by respecifying. Suppliers with new design and manufacturing ideas which save money are being welcomed at Dearborn, and planning is well along on numerous changes which will save pennies in future models without impairing quality.

Exemplary of the sort of thing which is being done is a proposed shift from an orthodox wheel design to another of very slight redesign, which makes possible the saving of a few cents' worth of steel. Another series of changes will simplify the design of steering wheels, so subtly the variations will scarcely be noticeable, but yet sufficient to cut few more pennies off the cost of each car. The entire car assembly is being looked at in this way, piece by piece, and the ultimate effect will be to hold down retail prices.

Paint Coolers—Studebaker has installed air blowers along its conveyor system at the end of paint touchup ovens to speed cooling of the metal. Previously, high temperatures of the bodies emerging from the ovens handicapped operators involved in the buffing and polishing processes

A.G.M.A. Announces Involute Spline Standard; Surface Standard Sought

CHICAGO—Promulgation of the American Standard for Involute Splines by the American Standards Association was announced at the 30th semi-annual meeting of the American Gear Manufacturers' Association at the Edgewater Beach Hotel, October 28-30. This standard was jointly sponsored by A.G.M.A., A.S.M.E., N.M.T.B.A., and S.A.E. Continued progress on other A.G.M.A. research and standardization programs was reported at meetings of engineering and commercial committees.

Louis D. Martin, gear engineer, Eastman Kodak Co., and L. J. Collins, research engineer, General Electric Co., are chairmen, respectively, of A.G.M.A. committees on fine-pitch gearing and inspection. These committees are collaborating on a standard for classifying and comparing surface roughness of gear teeth

Surface Roughness

A progress report on a standard for classifying and comparing surface roughness of gear teeth was submitted by Louis D. Martin of Eastman Kodak Co., chairman of the fine-pitch gearing committee This is a joint program sponsored by the fine-pitch gearing committee. This is the inspection committee, of which Laurence J. Collins of General Electric Co. is chairman. Mr. Martin said it is the purpose of this program to establish a uniform manner of classifying and comparing surfaces of gear teeth, not to appraise or set a value to the surface roughness of gear teeth. It is planned that this standard will furnish the means of a common understanding of the quality of surfaces of gear teeth, not how to use such surfaces or how they can be produced. It is the intention to classify different kinds of gear tooth surfaces, devise a means of comparing these surfaces with one another, and to evaluate different systems for measuring gear tooth surfaces.

The fine-pitch gearing committee, in collaboration with the inspection committee, is obtaining samples of spur gear teeth in the fine and coarse-pitch ranges produced by various methods. When a sufficient number of specimens have been collected and classified, the committee will select the groups that represent acceptable ranges of surfaces for each method of gear production.

Three Pitch Ranges

After the proper number of specimens has been gathered and decided on, they will be made into plaques and copied by the electroforming process. It appears likely that these plaques will have to be divided into three pitch ranges. These are the very-coarse, the medium-coarse and the fine-pitch ranges. Because of production difficulties the plaques probably will have to be made up of spur gear surfaces since helical teeth cannot be electroformed in multiples.

When the necessary plaques have been developed, the committee expects that they can be used in several ways, including (1) directly as visual comparators (2) as visual comparators and as masters from which transparencies can be made photographically or directly with Faxfilm, or (3) as visual comparators and as masters to be used in connection with the several available surface measuring instruments.

Establishment of a standard for comparing surface quality of gear teeth still means that the users of gears must determine which grades of surface quality are suitable for specified applications. Usually, designers are tempted to specify finer finishes than the application requires, with resultant increases in manufacturing costs. This, Mr. Martin believes, is largely due to the lack of a satisfactory method for comparing these surfaces.

Jet Gear Trains

In a talk on "Jet Propulsion and Gas Turbines in Aviation," Mr. H. J. Clyman, assistant to the manager of engineering, Aviation and Gas Turbine Division, Westinghouse Electric Corp., reviewed the early history of jet propulsion and gas turbines as applied to aircraft, and described basic types of these prime movers. He pointed out that the design of gear trains for driving accessories required on new axial flow gas turbines for aircraft use is critical because of the temperatures involved and the high pitch-line speeds. These gear trains are lubricated with low viscosity oil applied by spray nozzles. This presents a difficult design problem because the temperature of the oil sometimes reaches or exceeds its flash point.

Emery on Small Business

More than 300 A.G.M.A. members and guests attended this semi-annual meeting and heard DeWitt Emery, president of National Small Businessmen's Association, talk on the subject "What's Ahead For Small Business." One of the most dangerous of present day philosophies, according to Mr. Emery, is the doctrine of more pay for less production. Too many people believe in the "something for nothing" policy of the New Deal. He pointed out, however, that bad as the record of the New Deal may be, the record of the American business man is worse. All too few employees know what free enterprise mens.

Foundry Management, Techniques Discussed at Meehanite Meeting

CHICAGO—More than 150 management and production executives from foundries licensed by Meehanite Metal Corp. attended the corporation's three-day annual meeting on foundry practices at the Hotel Continental, October 31-November 2. Of particular interest was a paper on "Hydraulic Core Removal" prepared by Walter Horth of Cincinnati Milling Machine Co., and delivered, in his absence, by Herman K. Ewig of the same organization. It described an unusual installation for removing sand cores from castings with a flexibly controlled stream of high-pressure water. Two sizes of cabinets are employed, one for small castings moved into the cabinet on a roller conveyor, and the second for castings up to 32 ft. long handled by overhead crane.

During the major portion of the blasting operation, sand is introduced into the stream of high-pressure water to increase the cutting action. At the end of the operation, the sand supply is cut off and clean water is used to wash away any sand remaining on the casting. This work previously had been done by core chippers and it was impossible to keep the working area clean. The installation has proven effective in reducing accident hazards, making the work easier to perform, and in reducing casting cleaning costs.

Other subjects discussed at this meeting included production of castings with improved surface finishes, the manufacture of abrasion resisting castings, the mechanization of foundries and management items.

Washington Bulletin

WAA Master Plan

War Assets' new Master Plan is to sell 75% of current inventory by Jan. 1. At least 50% of that is to be offered in November; 80% by the end of December; and the balance in January. Paper work is on a 24-hr. basis; field officers are authorized to take direct action; sales pressure is on everywhere. Inventories will be completed even if mountainous stocks have to be counted. Of course when Littlejohn's drive is over, there'll be scads of odds and ends left for years. But WAA has handy men thinking up uses for everything.

Government Patent Control

Industry's fears over the patent situation have crystallized somewhat with Attorney General Clark's announced recommendation that the government retain full control of technology it pays for, most of which has come out of military funds to date. The recommendation is up for White House clearance.

Outstripping even the New Dealish Kilgore Committee's pending Science Foundation Bill, Clark is urging that the government itself take out patents and license them, selectively, to industry as a guard against monopoly. Kilgore stopped with dedication of such inventions to the public.

Opposition of industry is bolstered by the Army and Navy, which learned during the war that industry cooperated best when research and development contractors retained patent rights for commercial exploitation of what they learn in performing the contract.

Contract Terminations

Ninety-eight percent of war contract terminations have been settled, covering 90% of total canceled commitment value. From beginning of war production to Sept. 30, canceled commitments of $59 billion were settled for 5.9 billions or 10%. Remaining 2% of cases are tough ones and will take a long time. The work is difficult because nearly everybody gives priority to something else.

Defense Budgets Slashed

President Truman has been trying to balance the budget by chopping down Army and Navy expenditures, major items in cost of running the country. The President has already lopped two billions off defense authorizations, and the only way he can save another billion is to take it from defense. Armed forces commands are mad as hops, and are already climbing Capitol Hill with argument that newly gained Republican control should step in and save the nation's military face. And the Republicans will be damned, whether they do or don't.

War History Compiled

If you happen to be a government or industry official in any future war, you can read all about mobilization for the last one in a five-volume edition of the minutes of the War Production Board and its predecessors, compiled by Civilian Production Administration. It's called "Historical Reports on War Administration" and it covers major diplomatic events, industrial problems, and actions taken to solve them.

Employment Offices

With return on Nov. 16 of the nation's 1,800 public employment offices to state administration, Secretary of Labor Schwellenbach has fixed minimum standards for states to qualify for operating funds allotted by Congress. From a service standpoint, employers will probably find little difference under the new arrangement.

The standards are much the same as those installed by the U. S. Employment Service in taking over local employment offices in 1942. State officials will again determine "suitable work" in deciding whether a worker is unemployed and entitled to unemployment pay. Previously, the states made the payments on decisions made by federal officials.

The standards require state offices: to insure "so far as practicable" that workers are put in jobs utilizing their highest skills; not to recruit a worker for a job where wages, hours, or other working conditions offered are "substantially less favorable" than those prevailing in the area for similar work; and to make no referral that would aid in filling a job which is vacant because of a strike or lockout, or an issue in a labor dispute.

GE Plans Atomic Power Lab

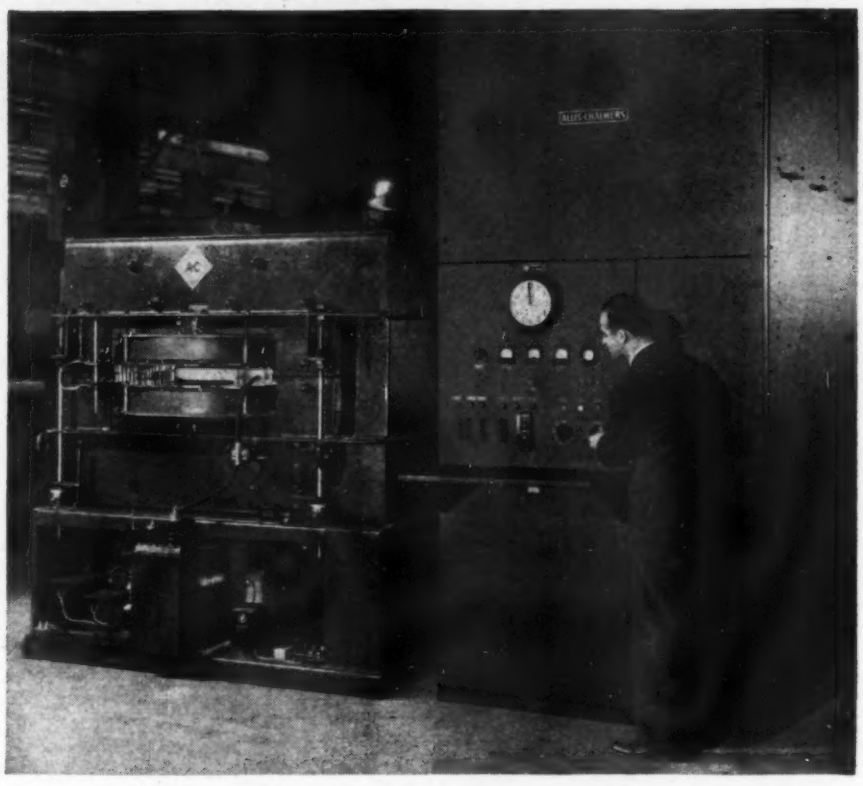
SCHENECTADY — Charles E. Wilson, president of General Electric Co., revealed his company will build and operate for the War Department a $20 million laboratory near Schenectady for the study of generation of power from atomic energy. GE has orders on hand for steam-turbine generators capable of producing 3.5 million kilowatts of electricity.

All steam-turbine facilities, located in several buildings at the Schenectady Works, will be housed in the new structure, which will cover approximately 19 acres. Thirty-one states and the District of Columbia will add sufficient power to light nearly 100 million household lamps with installation of the turbines, according to C. S. Coggeshall, manager of the GE turbine division.

War Equipment Storage—Part of the government program of storing equipment for future emergencies is shown here in the "canning" of tanks and other heavy ordnance equipment. Up to six tanks can be accommodated in one storage tank. The Army has established eight Materiel-Preservation Projects throughout the country

20,000,000-Volt Betatron X-Rays Heavy Sections

NEW YORK—An important development in the wartime shell program can now be used by heavy industries to detect internal flaws in billets, forgings, castings and weldments up to 20 in. or more in thickness. The Betatron, invented by Dr. D. W. Kerst of the University of Illinois, and built by the Allis-Chalmers Manufacturing Co., Milwaukee, is now available to private industry. These features of the machine were announced at a press preview on Nov. 14 of equipment just installed at Picatinny Arsenal, Dover, N. J.: (1) probable commercial usage will range from 4 to 24 in. in thickness; (2) the speed of film exposure makes it feasible to employ the equipment for 100% inspection; (3) flaws as small as 1/16 in. in diameter can be discovered in thicknesses of 20 in. or over, and 1/32 in. in thicknesses between 3 and 15 in.; (4) there is no fogging of film by backscattered radiation and hence lead shielding of film is less of a problem; (5) controls are simple, and (6) the price will be competitive with present types of one- and two-million volt X-ray equipment.



Penetrates Various Materials—The Allis-Chalmers Betatron, because of the low absorption of its highly penetrating X-rays, can be used to radiograph heavy sections of copper or nickel alloys as well as steel

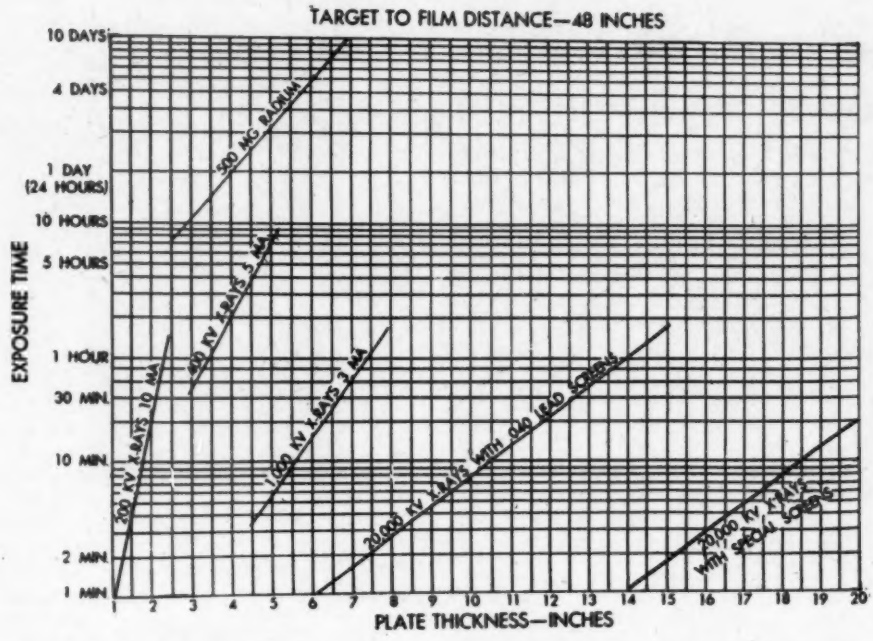
What the Betatron Is

The Betatron is an "induction electron accelerator." In conventional X-ray equipment, electrons are accelerated in vacuum by a high potential, strike a target, are converted to X-ray energy and emerge from the apparatus in all directions around the tube. To apply a potential like 20,000,000 volts is impractical because of insulation problems. Hence, the Betatron is built as a variant of the shell-type transformer. An evacuated "donut" tube is substituted for the secondary winding. Electrons are injected into the tube, and are caused to accelerate in an orbit therein by an increasing magnetic field in the core. When the electrons are whirling at approximately the speed of light, they are caused by electrical means to impinge on the target. X-rays emerge tangential to the orbit and in a narrow cone of 9° included angle.

Why 20,000,000 Volts?

In production of X-ray energy, as the accelerating voltage is increased, the frequency increases and the wavelength of the rays decreases. Radiation of any X-ray machine is a spectrum in that it contains various intensities of every wavelength above the minimum (determined by the peak voltage employed). Dis-

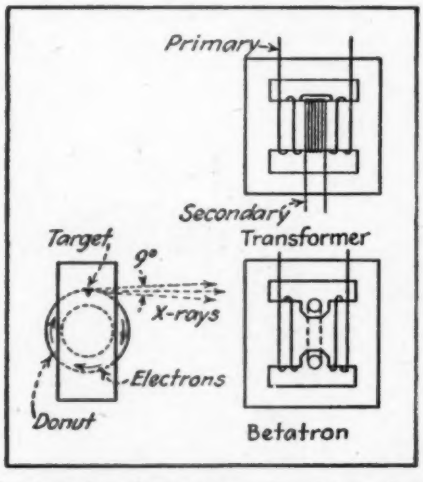
At Picatinny Arsenal—Shell up to 1 ton will be X-rayed on circular conveyor at speeds up to 80 per min. Larger projectiles will be positioned in front of Betatron by overhead crane or other work handling means


TARGET TO FILM DISTANCE—48 INCHES
EXPOSURE TIME
10 DAYS
4 DAYS
1 DAY (24 HOURS)
10 HOURS
5 HOURS
1 HOUR
30 MIN.
10 MIN.
2 MIN.
1 MIN.
500 MG RADIUM
400 KV X-RAYS 5 MA
200 KV X-RAYS 10 MA
100 KV X-RAYS 3 MA
20,000 KV X-RAYS WITH .040 LEAD SCREENS
20,000 KV X-RAYS WITH SPECIAL SCREENS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
PLATE THICKNESS—INCHES

Internal Flaws Speedily Found—Steel 20 in. thick can be radiographed with the Betatron in 20 min.; sections 4 in. thick in 4 sec. This chart compares exposure times for various methods on the basis of standard film and technique

tribution of wavelength is important, because absorption of radiation in any metal is dependent on wavelength or frequency. The rate of absorption is high at low frequency (long wavelengths—low voltages), but decreases with increasing voltages until a minimum absorption is passed and then rises again. It so happens that minimum absorption in iron occurs in the neighborhood of 7,000,000 to 8,000,000 volts, and it is likewise a fact that in the 20,000,000-volt Betatron the spectrum is rich in useful X-rays in the band slightly below 10,000,000 volts.

This matching of spectrum characteristics with low absorption is responsible for realization of deep-penetration power. Thicknesses of 4 to 22 in. are readily penetrated at exposure times of a few seconds up to one hour. Considerable work has been done in X-raying 20 in. sections in 20 min. Hence, the bulk of heavy industrial work, which presumably lies between 12 to 16 in. in thickness, can now be examined quickly in contrast to the days required by another available method — the radium capsule.



Principle of Betatron—To obtain desired penetrating power, electrons are accelerated in a circular path, strike a target, are converted to X-ray energy emerging as a narrow cone

Small Defects Found

Because of the absorption characteristic mentioned, Betatron radiation is said to have absolute sensitivity. This means that the size of minimum detectable flaw with a given film setup is independent of the total thickness of the work. High-contrast films will show flaws 1/32 in. deep in the direction of the X-ray beam by 0.002 in. wide in steel of thicknesses of 3 to 15 in. diameter. Where the piece has extreme variations in thickness and detection of 1/16-in. flaws is adequate, lower contrast films can be used. With all films a lead screen 0.040 in. thick should be placed directly in front of and in contact with the film. It is unnecessary to block around the edge of an irregular object. Placement of lead behind the film cassette is not needed for thicknesses of less than 12 in. No shielding is required to prevent back-scattered radiation, because X-rays of the intensity produced do not cause secondary radiation in the direction of the primary ray, except in very thick sections.

By placing the film at some distance behind the object, enlargements can be made on the film. Thus clearances in assembled mechanisms can be checked.

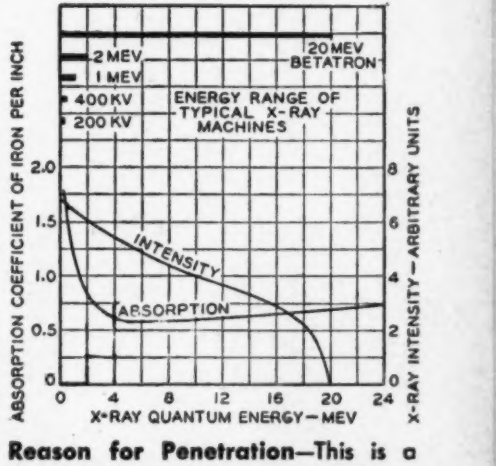
Manipulation of Work

Since the bulk of the radiation emitted falls within a 9° cone, objects like 10 in. shell would be examined on a circular conveyor placed 3 to 4 ft. from the machine. A standard 14x17 in. film is well-covered at 8 ft. Objects can of course be placed at distances up to 15 ft. or more in order to get larger coverage if need arises. While with the present machine, it is necessary to manipulate the work in relation to the target, effort is now being directed toward producing a unit that will be portable, or can be manipulated with respect to large workpieces.

Protection of Personnel

Because of intensity of Betatron radiation, heavy shielding is required in the direction of the beam. At Picatinny Arsenal, the back wall facing the unit is approximately 5 ft. thick concrete. Other materials could be used. However, back scatter is slight and dangerous secondary radiation is not built up, so that protective walls at the sides and back of the Betatron are 20 in. thick.

The control apparatus and panel are built as a separate unit situated at the side or rear of the unit with the protective concrete curtain in between. The X-ray density meter can be preset to any desired value and the Betatron will shut off after sufficient X-radiation has been reached.



Reason for Penetration—This is a theoretical curve, but new experimental data show minimum absorption of X-rays by steel occurs for rays of 7 to 8 million volt intensity. Spectrum of 20,000,000-volt Betatron is rich in wavelengths of desired intensity

Contract Shop Problems Aired at Tool & Die Association's Meeting

CHICAGO—A lively and heated discussion of the cost of having tools and dies made in contract shops as against "captive" shops developed at the panel meeting on "Good Service on Special Tooling" at the first annual convention of the National Tool & Die Manufacturers Association on Oct. 25. The issue was first raised by Bert Hall, tool supervisor General Electric Co., Erie, Pa., who said that work done outside by his company during the war cost 100% more than when it was done inside. He professed inability to understand why the work could not be done in the same number of hours as General Electric is able to do it.

Mr. Hall precipitated comments from contract shop men that customers often do not know what their costs are and that they do not charge enough overhead to tool and die jobs done in their own shops. One contract shop owner said that contract shops should admit that hours on jobs today are longer than they were five year ago, mostly because customers are demanding the usual prompt and efficient service under today's hectic conditions of materials and labor shortages.

Customer Cooperation Asked

Many contract shops do not possess enough inspection equipment, declared Mr. Hall. Inspection staffs should be divorced entirely from manufacturing operations. If a mistake is made in a drawing or plan, said Mr. Hall, the customer should not hold the contract shop responsible for making a die or fixture which will work.

If one assumes that time and material work is placed with a well-qualified contract shop, even that shop is at the mercy of the human element and the contractor should not be expected to pay for errors over which he has no control, remarked Frank W. Denning, Denning Mfg. Co., Cleveland. He added that the customer who designs a job should follow it all the way through and detail it before handing it to the contract shop. Moreover, customers should ask for bids from a small number of shops and award all the work to one shop, giving that shop the chance to even up between individual jobs on which it is low and those on which it is high.

Prices and Know-How

Purchasers should not expect contract shops to build tools exactly to specified designs, but should rely upon the practical experience of men who are in the toolmaking business every day to make desirable modifications, asserted R. W. Updike, tool supervisor Schwitzer-Cummins Co., Indianapolis. The question of costs often simmers down to knowing customers, some wishing their tools nicely finished and others wanting nonessentials eliminated. Part of the customer's responsibility, said Mr. Updike, is to know where to ask for quotations on jobs.

Customers will complain about prices, but will squawk a lot more about bad tools, said Joseph N. Huser, B. & H. Specialty Co., Indianapolis. He declared that great stress should be put on keeping delivery promises. Small shops have advantages of close controls, quick action for the cutomer and elimination of red tape. These shops, on the other hand, are going to have to specialize, because this is the day of specialization.

Costs and Volume

Contract shops are not as interested as they should be in the customer's product, commented Robert C. Eisenmann, purchasing agent Union Special Machine Co., Chicago. They should learn more about it. They also should know what the tools ordered are to be used for and how they are to be used. If the tools cost a bit more, but will cut costs and be worth the money, the purchaser should consider this and refrain from complainng.

Tool shop owners figure on feast or famine, said Richard F. Moore, president Moore Special Tool Co., Bridgeport, Conn. When there isn't much work, they bid low to get jobs. When there is lots of work, they bid high and make up for previous losses. One of the reasons for a trade association is to smooth out some of the inequities in buying and some of the unfair practices indulged in by some tool and die shops.

N.T.D.M.A. President

Willis G. Ehrhardt

OTHER OFFICERS OF NATIONAL TOOL AND DIE MANUFACTURERS ASSOCIATION

1st Vice President

William R. White, Jr.

2nd Vice President

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Secretary

John H. Benetz

Treasurer

Herbert F. Jahn

Foreign Report

BASED UPON MCGRAW-HILL WORLD NEWS BUREAU REPORTS

International Standards

LONDON—A new "International Organization for Standardization" will be born as a result of a conference of the representatives of the national standards associations of 25 countries held recently under auspices of the United Nations Standards Coordinating Committee. The organization will remain independent of UN but will offer its service as a consultant.

Established basically to achieve a world-wide unification of standards, the new group will afford engineers of all nations the opportunity of working together on an international level to reach accord on a common basis for certain standards established by their national groups.

Taking over and expanding activities of the old International Standards Association, the ISO will have more secure financial backing and will be spurred by wartime revelations to an even keener awareness of the need for unification.

Coonley First President

Of marked significance was the high standing accorded America's technical prowess, which culminated in the unanimous selection of Howard Coonley, executive committee chairman of the American Standards Association, as the first president. Mr. Coonley has been a vigorous exponent of standardization since his retirement on Jan. 1 as board chairman of the Walworth Company.

Gustave L. Gerard, president of the Insitut Belge de Normalisation, was elected vice-president, and M. F. Streiss of Switzerland, treasurer. A general secretary will be chosen before the first meeting of the 11-man Council, which will serve as the administrative body, scheduled for May 1947. The constitution, effective upon ratification by 15 nations, provides for a General Assembly to meet every three years. Each member nation will have one vote.

The Russian delegation evidenced willingness to cooperate fully with the other countries, inserted no provisions for a veto-power, and made no claims for a permanent seat on the Council. The delegates insisted, however, that Russian be included with English and French as the official language for publications of the ISO.

Virtually the whole field of business and technology will come within the purview of ISO. A member nation will propose a subject and it will be circulated among the entire membership. If five members concur, the proposal is brought before the Council. If the project meets Council favor, it will be assigned to a working committee which will be assisted by the technical resources of one or more nations. The report will then be considered by the General Assembly and, if approved by three-fourths of the group, the contents will be issued as an ISO recommendation. Groups from individual nations can then promulgate the agreed-upon basis as a national standard for their respective countries, or reject it.

The term "international standard" henceforth will not be used to refer to any such agreed common standard unless all member of the ISO have adopted it and placed it into effect.

Administrative work will be carried on by the United Nations Standards Coordinating Committee office in London until the ISO begins functioning at its permanent headquarters in Geneva. Member nations will pay the cost of operations on a sliding-scale basis. The budget for the first year is $50,000.

Czech Reconversion Show

PRAGUE—Postwar strides of Czechoslovakian industrialists were exhibited recently at the Prague Fair. Peacetime equipment, ranging from aircraft, textile, farm and heat-treating to home accessories, gave evidence of the speed with which Czechs have reconverted.

Representatives of machine tool companies are expansion-minded and have hopes of replacing German industrialists in the markets of the world. Hubert Ripka, Czech minister of foreign trade, left no doubt of the nation's export desires by stating at the Fair that "70% of our goods must be exported and any hard-cash buyer from abroad is welcome no matter where he comes from."

Much of the equipment reflected the speed of technological developments and refinements.

Russian Tractors Sped

MOSCOW—Russia's two world-famous tractor plants at Stalingrad and Kharkov have turned out 7,000 and 3,000 tractors respectively since reconstruction began. Diesel-powered tractors are being produced at the Stalingrad Works. Evacuated equipment of the Kharkov Works remains in the Altai region and will continue to function. The original Kharkov Works, ruined by war, is being rebuilt.

Indian Ship Yard Planned

BOMBAY, INDIA — Establishment of a shipbuilding yard which ultimately will be able to construct steel vessels of up to 5,000 tons is projected for the port of Bhatkal on the Arabian Sea 300 miles below here in Southern Bombay Province. Backers of the venture are in Great Britain making final arrangements for buying equipment and employing British technical experts.

Guns to Tractors—The Bren plant, famous for its wartime gun production, was a substantial exhibitor at the Prague Fair. Some of its peacetime production includes a tractor, motorcycles and textile equipment

Rise In Coal Prices Held Certain As Lewis Spars With Government

WASHINGTON — Repeating tactics he used last March in dealing with the private owners of the nation's coal mines having agreements with the United Mine Workers, AFL, John L. Lewis, union president, made no specific wage demand when he sat down with Interior Secretary J. A. Krug, government operator of the seized mines, to talk about changing the contract signed May 21.

All that came out of the early meetings was that the U. M. W. wanted to shorten the work week of 54 hours (including an estimated six hours of travel time) and at the same time wanted a wage increase to reduce, if not prevent, any loss in weekly take-home pay.

All Industry Affected

Whatever comes out of the negotiations, be it a strike, a wage increase, or a reduction in weekly hours at higher pay—maybe all of them—it will mean higher costs not only to the mine operators, when and if they get their mines back, but to all industry using coal. The $1.85 daily raise granted last May forced coal prices up last summer, and another wage boost is bound to push them still higher, although the union suggests that a raise can be absorbed through savings resulting from the reduction of the time and a half now paid for 19 of the 54 hours worked.

What the union means is that, with a 54-hour week and overtime after 35 hours, the miners are being paid for 63½ hours, or $75.24, which brings the average hourly pay for the 54 hours to about $1.39½. If the work-week is cut to five nine-hour days—45 hours—only 10 of which would be at penalty wages, it is argued that the hourly rate could be raised five cents and still keep the average at $1.39½. And, of course, if the work-week is cut still further, say to the 35 hours originally intended, the rate could be upped still higher with raising the average.

Operators Cite Views

But coal mine operators were quick to point out that a shortening of the work-week with reducing coal production would raise the amount of overhead per ton of coal. Besides, if the work-week is to be cut, it won't be reduced enough for the present to permit enough wage increase under this formula to satisfy Lewis, who is in a struggle with the C.I.O. for dominance of the labor movement.

There have been seven major soft coal strikes in the past three years. Five times the government has seized the mines under the Smith-Connally Act, and Lewis has won his demands with the aid of the very law that Congress passed in June, 1943, in an attempt to cope with him. This is one law certain to be wiped off the books by the Republican Congress.

Because of last spring's strike, this year's production up to Oct. 26 was only 438 million tons, 33 million below the same period last year.

Coal stockpiles on Oct. 1 were considered low. The 52,367,000 tons accumulated would last industry as a whole an average of 37 days at normal consumption, but it varied from 12 to 70 days depending on the industry, according to the Solid Fuels Administration.

Here's the average number of days' coal supply held by various industries on Oct. 1: Electric power utilities, 70; cement mills, 41; steel and rolling mills, 35; Class I railroads, 30; by-product coke ovens, 23; retail dealers, 12; other industries, 58.

The 5-cent royalty on coal produced has created a health and welfare fund of more than $11 million for bituminous coal miners and more than $1 million for anthracite workers.

Peaceful Picketing Marches On—Despite sporadic attempts to enforce peaceful picketing rule, union members continue to use strong arm tactics to prevent these workers from crossing the picket line. In this scene, pickets are attempting to stop or overturn an auto while helpless patrolmen look on outside the Allis-Chalmers plant, West Allis, Wis.

Inland Buys Blast Furnace

EAST CHICAGO, IND.—As part of the steel industry's general attempt to offset scrap shortages by increasing output of pig iron, the Inland Steel Co. has purchased for $13,250,000 from the War Assets Administration, a government-owned blast furnace and by-product plant here. The property consists of two blast furnaces (one incomplete) each with an annual capacity of 427,000 tons of pig iron, two batteries of coke ovens with a combined capacity of 728,400 tons of coke annually, and by-product facilities.

Inland Steel, which operated the plant during the war, has been leasing it since, although it has not operated the completed blast furnace since January, even though it has kept the coke ovens in continuous production.

WAA AID TO SMALL BUSINESS

WASHINGTON—Small business is assured of an equitable share of the $23.8 billions of goverment surplus, under a renewed effort by the War Assets Administration. Six WAA zone heads, working with district offices, will represent small business on Regional Inter-Agency Small Business Groups of RFC. Department of Commerce, and WAA. This set-up will help customers find what they want in new or used markets.

GM and Packard Launch Expansion Plans Despite Shortage Headaches

DETROIT—Despite shortages and production headaches, tangible signs of expansion activity for the future became evident in recent weeks as General Motors and Packard Motor Co., revealed ambitious changeover programs involving millions of dollars.

GM officials prepared to file a $100,000,000 stock issue with the Securties and Exchange Commission to finance its modernization and expansion program and add to its working capital to meet expected demands for GM products. GM plans call for construction of new units and enlarging existing facilities.

Meanwhile Packard has earmarked $20,000,000 for reconversion and plant expansion as well as tooling and engineering for its next new models and other production—marine and aircraft engines, etc. The tooling program for the new Packards, which the industry expects to see late next spring, is already well underway, George T. Christopher told a Detroit press conference.

A million dollars is being spent to renovate the Packard Proving Grounds at Utica, Mich., used by Army Ordnance during the war. Engineering budgets have doubled previous peaks.

Packard is shooting at a goal of 65 assemblies an hour, and has about completed equipping a second production line to achieve this aim. Up to now, one line alone has been running, reaching somewhere in the neighborhood of more than 36 or 37 cars per hr., due to materials shortages.

Mr. Christopher has insisted that rapidly accumulating shortages threatening the industry would be dispelled by lifting of OPA price controls on new cars and materials necessary for their construction. He cited October as Packard's best production month this year.

AIR-CONDITIONING UNITS TIE-IN WITH NEW PLANTS

CLEVELAND — Air-conditioning and electrical load-center equipment to fit neatly between two welded H-section trusses on new structures having spans of 60 ft. or more has been worked out by The Austin Co., Cleveland engineers and builders as another step in their program for controlled-condition plants.

Austin engineers say benefits include elimination of custom-designed equipment in favor of standard air-conditioning equipment; saves valuable floor space; is easier to service; equipment can be ordered before detailed construction drawings are started; assembly work can be done on platforms which are then hoisted above the bottom chord of trusses; eliminates the usual penthouse, and affords flexibility.

The integrated unit-area system is said to answer the need for economical installation of an air-conditioning system regardless of floor space, the units being spaced to serve an area from 8,500 to 20,000 sq. ft.

Designed for use in construction of new buildings, there is little advantage in using this type of installation in buildings already completed.

Cincinnati Milling Machine Makes Major Personnel Changes

Sol Einstein, vice president, and Dr. Otto P. Geier, director of Employees' Service Department, Cincinnati Milling Machine Co., have retired, according to an announcement made by Frederick V. Geier, president.

Sol Einstein

Mr. Einstein had been associated with the company since 1903. In 1920 he became chief engineer and in 1936 was made vice president and a director. He has been active in the American Society of Mechanical Engineers, at present being chairman of the Production Engineering Division.

Dr. Geier had been head of the Employees' Service Department for 33 years and was an ardent advocate of industrial medicine. In 1913 he brought his doctor's office into the plant of the Cincinnati Milling Machine Co. and eventually convinced workers and management all over America that fully equipped and staffed medical departments in industry were an economic necessity. His writings have appeared in practically every accredited medical journal in the country. He has served as an officer and director of the company for 30 years.

Otto P. Geier

Philip H. Cone

Lincoln Mehlhope will take over Mr. Einstein's duties, while Dr. Geier's activities will be handled by Philip H. Cone, with Dr. Geier as consultant. Mr. Mehlhope has been connected with the company since 1924 and is an engineering graduate of the University of Cincinnati.

Carl F. Roby has been appointed assistant to Walter W. Tangeman, vice president and general manager of Cincinnati Milling Machine Co. Mr. Roby is a graduate of the University of Cincinnati and, except for a period of war service in 1918-1919, has been connected with the company since he began as a Co-op in 1916. He became works manager in 1929, and five years later was sent to Birmingham, England, as managing director of Cincinnati Milling Machines, Ltd.

L. E. Mehlhope

Carl F. Roby

Ferris M. Angevin has become treasurer of Cincinnati Milling Machine Co. He formerly was secretary.

Millard Romaine has been appointed sceretary of the company. He has been associated with the company since 1921 and served as general sales manager from 1938 to 1941.

Millard Romaine

F. M. Angevin

Spotting the Air News

AAF Wins Missile Control

Army Air Forces has won its battle with Army Ordnance for control of the guided missile program. Heretofore, AAF has had the development of winged missiles, such as gliders, pilotless aircraft, engine-powered bombs, etc., un-manned and guided by various forms of radiation. Ordnance has had those missiles that fly without wings, propelled by jets and rockets. Hereafter, by specific directive, AAF will determine the entire program, assigning what it sees fit to Ordnance. Third party, making a triangular contest for missile control, is the Navy. But AAF, formerly the Army's tail but which now wags the dog, is also bigger than the entire Navy. It will pay metalworking industry to warm up its contacts with AAF, which may hold permanent control of missiles, major future weapon.

British All-jet Power

The British Avro Lancastrian, powered by two Rolls-Royce Nene jet engines and two R-R Merlin reciprocating engines is aimed of course at all-jet power for bomber and transport aircraft. After takeoff, the Lancastrian stops its propeller engines and flies on jet alone, with no vibration and no noise, except the swish of air around the ship. These comfort features will be highly prized by air travelers, and by multitudes on the ground who complain bitterly of bedlam overhead. Development of jet for private planes is only beginning; it will be more difficult because of low speed, at which jet is inefficient. Predictions that decline of reciprocating engines would seriously curtail metal work may have been hasty: jet and gas turbines are acquiring more and more machined parts. As one mechanic recently commented: You can trust the experts to make simple things complicated.

Military Aircraft Orders

Though about half of this year's less-than-a-billion dollar airplane business is in civilan types, the military air arms are by no means neglecting to keep their sources well oiled. AAF has orders out with 16 major airplane manufacturers for at least 41 types, and Navy has contracts with 14 companies for at least 21 types. In addition, both services have awarded important development contracts, most of which are held under closer security wraps than at the war's end.

Veil Lifted on Lycoming

Just as reciprocating airplane engines reach their declining days, the world's biggest one comes off the secret list. It is the Lycoming XR-7755, liquid radial, developing 5000 hp. Its four banks of 9 cylinders each are cooled by circulation of 750 gallons of liquid per min. The propeller is driven through a two-speed dual-rotation reduction gear, with hydraulic shift. The champion burns a stream of gasoline as big as a hoe-handle: 280 gal. per hr.

Fixed Landing Gears

Some light airplanes may always have fixed landing gears: retracting types weigh up, and cost money. Cessna has a spring-steel gear, much simpler than the usual oleo dashpot type, that may lead future practice. Company has put out 3000 planes with the new spring, and is still waiting for a serious gear failure, though some brutal landings have been reported. Cessna saws both legs of the undercarriage from a single piece of chrome molybdenum alloy steel.

Seagoing Helicopter—Extending the uses to which a helicopter may be put, Bell Aircraft Corp. has equipped this model with floats for landings on water. Thoroughly tested, the plane has been granted an NC license by CAA. Enthusiasts predict that retractable wheels will be added for taxiing into hangars

ATOMIC ENERGY FOR PEACE GUIDED BY 5-MAN BOARD

WASHINGTON — Charged with the vital role of developing and operating peacetime applications of atomic energy, a five-man commission named by President Truman will concern itself with atomic-fueled power and mass production of radioactive by-products for research and medicine.

David E. Lilienthal, 47-year-old head of the Tennessee Valley Authority, who chairmaned the five-man State Department Board which prepared fundamentals of an international atom control plan now before the UN Atomic Commission, is chairman.

Other members are: Robert F. Bacher, professor of physics and director of the Laboratory of Nuclear Studies at Cornell University; William W. Waymack, vice-president and editor of the Des Moines (Iowa) Register and Tribune; Lewis L. Strauss, partner in the banking house of Kuhn, Loeb and Co., World War I secretary to Herbert Hoover and originator of the World War II "E" award; Sumner T. Pike, New England and Wall Street gas company promoter.

Most Vets in Auto Industry

DETROIT—The automotive industry leads all other manufacturing industries in the employment of veterans of World War II. Out of every 100 persons employed in the industry, veterans make up 27. The average for all industries is reported to be slightly over 18 veterans for every 100 among the 3,900,000 employees of 6,400 reporting companies, according to the U. S. Bureau of Labor Statistics.

Names in the News

Marshall M. Smith

Walter S. Praeg

Marshall M. Smith, vice president and director of E. W. Bliss Co., Detroit, has been elected president, as of December 1 when **D. S. Harder,** current president, will leave to assume duties as vice president in charge of operations of the Ford Motor Co.

Walter S. Praeg, vice president, has been elected president of the National Broach and Machine Co., Detroit to succeed the late **Robert S. Drummond,** who organized the company. Also, **J. Irvin Schultz,** who has been with the firm for 13 years, has been elected vice president and treasurer.

D. B. Acker, general manager of operations of Menasco Manufacturing Co., Burbank, Calif., has been named vice president in charge of operations and a director. For many years, Acker served as a production executive of the Fisher Body Div., General Motors Corp.

E. B. Andrews has been appointed sales manager of the O.K. Tool Co., Shelton, Conn. For many years he was in charge of sales for E. A. Kinsey Co., Cincinnati.

John L. Hallett, previously plant manager of the Southern California division of Kaiser-Frazer Corp., has been appointed vice president and chief engineer of Kaiser-Frazer Corp. and Graham-Paige Motors.

Russell P. Proffitt, Chicago divisional manager of The Timken Roller Bearing Co. since 1933, has been transferred to the Washington office as district manager. Also, **H. B. Lilley,** a Timken development engineer on alloy mechanical tubing, has been appointed district manager of the Timken Steel and Tube Div. with headquarters in Houston, Texas.

Joseph L. Collins has been appointed chief engineer of Aerovox Corp., New Bedford, Mass.

Robert C. Troup has been elected president of the Keystone Manufacturing Co., Buffalo, N. Y. to succeed **Edward J. Micklin,** retired. Also, **Edward J. Krueger,** vice president, has also been named general manager in charge of production.

Dr. John Johnston has retired as director of the research laboratory of the United States Steel Corp. of Del. and has been succeeded by **Dr. J. B. Austin,** assistant director.

Robert L. Burke has been appointed mid-western sales representative of LaSalle Engineering Co., Chicago.

Francis F. Braun has been named to head the product development division of Burton-Rodgers, Inc., Cincinnati.

Frank J. Kohut, formerly sales manager and chief of development, of The C. M. Kemp Mfg. Co., Baltimore, Md., has been advanced to the post of general manager.

G. P. Torrence

Harry F. Smith

George P. Torrence, executive vice president of Link-Belt Co., Chicago, for the past few months, has become president of the company succeeding **William C. Carter.** Mr. Torrence was formerly president of the Cleveland Pneumatic Tool Co.

Harry F. Smith has been named vice president in charge of manufacturing and a director of the Acklin Stamping Co., Toledo, Ohio.

Roger P. Holman, formerly assistant to the president of the Boeing Aircraft Co., Seattle, Wash., has become assistant to the vice president in charge of production manufacturing, while **C. M. Weaver** has been named general superintendent of the factory department and **Ted Emmert,** formerly assistant to the executive vice president, has been made materiel supervisor.

J. R. Barefoot, formerly plant engineer, has been named executive assistant to the executive vice president and treasurer of the Federal Machine & Welder Co., Warren, Ohio.

George D. Melling, Jr., has been named chief engineer of the Snyder Tool & Engineering Co., Detroit, to succeed **William C. Oberem,** who resigned to join Farrel-Birmingham, Inc., Buffalo, N. Y.

G. D. Melling, Jr.

Ward R. Shafer

Ward R. Schafer has been named general sales manager of Ideal Industries, Inc., Sycamore, Ill. Mr. Schafer has been vice president in charge of sales of Edison General Electric Appliance Co., Chicago.

Dause L. Bibby, executive assistant at the Endicott plant, has been named general manager of the International Business Machines Poughkeepsie, N. Y. plant where he will be in charge of all manufacturing, engineering and research activities.

Henry W. Luetkemeyer has been named chief engineer of the Cleveland Graphite Bronze Co., Cleveland. He has been associated with the company's engineering division since 1935.

L. S. Barksdale, former vice president and general manager of the hydraulics division of Saval Co., Los Angeles, has been named president of the firm. **E. Sanford,** retiring president, will devote his time to Sanford & Co., a wholly owned subsidiary.

O. W. Irwin, manager of concrete bar sales of Carnegie-Illinois Steel Corp. retired Nov. 1.

Paul Hacker has been named operating manager of the Pioneer Engineering & Manufacturing Co., while **Ted Campbell** has become chief die engineer.

D. J. Hasinger has been appointed general manager of the Paul and Beekman Div., Portable Products Corp., Philadelphia, Pa.

BUSINESS ITEMS

Lodge & Shipley Machine Tool Co., Cincinnati, has acquired the product and patent rights of the "duplimatic," a contour reproducing device for use on metals, from the **Detroit Universal Duplicator Co.,** for manufacture by Lodge & Shipley's machine tool division.

The Winfield H. Smith Corp., Springville, N. Y. has been formed to take over and continue the business of **Winfield H. Smith, Inc.,** designers and manufacturers of speed reducers, gears and transmission machinery for gears. **James F. Murray,** president; **Duncan A. MacLeod,** vice president, and **Irving L. Fisk,** secretary are the incorporators and directors of the firm.

Lincoln Electric Co., Cleveland, has established a new office at 3343 Central Ave., Indianapolis, Ind. with **R. W. Sharp** as district manager and sales engineer of the office.

National Merchandisers, Chicago, has established a marketing service for new inventions to deal mainly with engineering analyses, market surveys and invention sales.

The Portable Products Corp., Pittsburgh, has purchased the **Great Western Fuse Co.** and the **LaMar Indicating Fuse Corp.,** Pittsburgh, and will operate both firms as subsidiaries.

Carpenter Engineering Co. has moved to 2462 E. Seven Mile Rd., Detroit.

General Electric Co. has established two **Aviation Divisions,** formerly sections of the Apparatus Department's Industrial Divisions. **John C. Miller** has been appointed manager of the divisions, while **Robert A. Averitt** will serve as manager of the **Aircraft Accessories and Ordnance Division** at Schenectady, and **E. S. Thompson** is manager of the **Aircraft Gas Turbine Division** at the G. E. River Works, Lynn, Mass.

Broden Construction Co., Cleveland, manufacturers of strip steel and wire mill equipment, has changed its name to the **Wean Equipment Corp.**

Logan Engineering Co., Chicago, has appointed **Patterson Sales Co.,** El Paso, Texas, as its Aridifier distributor in Ariz., N. M., Mexico and Central America.

General Riveters, Inc., Buffalo, N. Y. has purchased the **J. E. Martin Equipment Co.,** Buffalo.

Carboloy Co., Inc., Detroit, has appointed the **Wm. H. Taylor & Co., Inc.,** 256 Hamilton St., Allentown, Pa. as its authorized distributor of cemented carbide tipped cutting tools in the Allentown-Bethlehem-Easton area in Pa.

Puget Die Casting Co. has been organized in Tacoma, Wash. to manufacture high pressure zinc, aluminum, magnesium and bronze alloy castings. Officers of the firm include: **George A. Lund,** president and general manager, **T. Harbine Monroe,** vice president and treasurer, and **Hardyn B. Soule,** secretary.

The American Coach & Body Co., Cleveland, has established an Oakland, Calif., plant to supplement production of standard utilities equipment, bodies and aerial ladders for motor vehicles. **Fred C. Hall** will be in charge and **Henry Kipp** will be chief engineer.

Harvill Manufacturing Co. has moved from Los Angeles to Corona, Calif.

Tubular Products Co., Southington, Conn. has been acquired by the **Jackson Tube Co.,** Piqua, Ohio. The company manufactured tubing for airplanes, automobiles and bathroom accessories. **Orville H. Bailey** continues as president and general manager.

OBITUARIES

Thomas Morrison, 84, a director of The International Nickel Co. of Canada, Ltd., and a former director of United States Steel Corp., died Oct. 26. For many years he was associated with the Carnegie Steel Corp. and together with Julian Kennedy, he was co-inventor of a process of slow cooling for rails, known as the Kennedy-Morrison Process.

Howard B. Carpenter, 64, retired vice president of Republic Steel Corp., died Oct. 29. Mr. Carpenter started with the Cambria Steel Co. in 1905 and 14 years later joined Colorado Fuel & Iron Co., where he remained until he joined Republic Iron & Steel in 1928 as manager of the Youngstown district. His invention, the Carpenter coal drier, has been used in most coal cleaning plants for the last 25 years.

William Paulus, 57, vice president and factory manager of Trico Products Corp., Buffalo, died Oct. 29.

Walter Perry, 81, former president of Farrel-Birmingham Co., Inc., passed away Oct. 31. He joined the Farrel Foundry & Machine Co., Ansonia, Conn., before its name was changed, as purchasing agent and retired in 1929.

Samuel H. Moore, 65, for many years president of the Chisholm-Moore Mfg. Co., and more recently a sales engineer for the National Bronze and Aluminum Foundry Co. died Oct. 29.

Harold L. Brainerd, 57, president and manager of the Brainerd Manufacturing Co., East Rochester, N. Y., passed away Oct. 25.

R. B. Nixon, 83, retired salesman for E. C. Atkins & Co., Indianapolis, Ind., died Oct. 7. He joined Atkins in 1907 and served the Minneapolis, Minn. and Virginia, North Carolina territories during his 38 years with the company.

Stanley M. Prior, 60, manager of distributor sales, Fafnir Bearing Co., New Britain, Conn., passed away Oct. 22.

Leroy M. Wheeler, 64, founder and manager of the Wheeler Equipment Co., Buffalo, N. Y. died Oct. 29.

John R. Morrison, 52, sales manager for the Rex Metal Works, Seattle, Wash. passed away recently.

Col. Carl M. Tichenor, 59, vice president and general manager of the Doyle Manufacturing Co., Syracuse, N. Y., died Oct. 30.

Cyrus C. Chamberlain, Sr., for many years president of the Blakeslee Forging Co., Southington, Conn., passed away Oct. 21.

MEETINGS

National Association of Manufacturers. Annual Congress. Waldorf-Astoria Hotel, New York, N. Y. Dec. 4-6. National Association of Manufacturers Association, 14 W. 49 St., New York, N. Y.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York, N. Y. Dec. 2-7. Charles F. Roth, manager, Grand Central Palace, New York, N. Y.

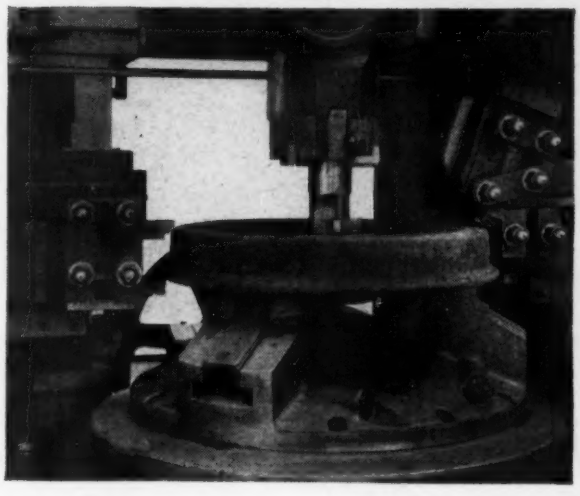
National Materials Handling Exposition. Public Auditorium. Cleveland, Ohio. Jan. 14-17. Ezra W. Clark, chairman, P. O. Box 178, Battle Creek, Mich.

Society of Automotive Engineers. Annual meeting and engineering display. Book-Cadillac Hotel, Detroit, Mich. Jan. 6-10. John A. C. Warner, general manager, 29 W. 39 St., New York, N. Y.

Shop Equipment News

Cincinnati Planer's Boring and Turning Mill Has Automatic Operation; New Chucking Method

PRODUCTION TIME has been reduced considerably in the Cincinnati Hypro automatic boring and turning mill produced by The Cincinnati Planer Co., Oakley, Cincinnati 9, Ohio. A new chucking method centers the wheel so that after it has been machined the rim thickness is balanced. The three chuck jaws operate from a central lever and hold the wheel in position with the hole free for boring and the rim, flange, and tread free for turning.



Rolled steel wheels are bored and turned on the machine below at an average of six per hour. Right: The rough wheel is seen in the unusual chuck ready for start of the machining cycle

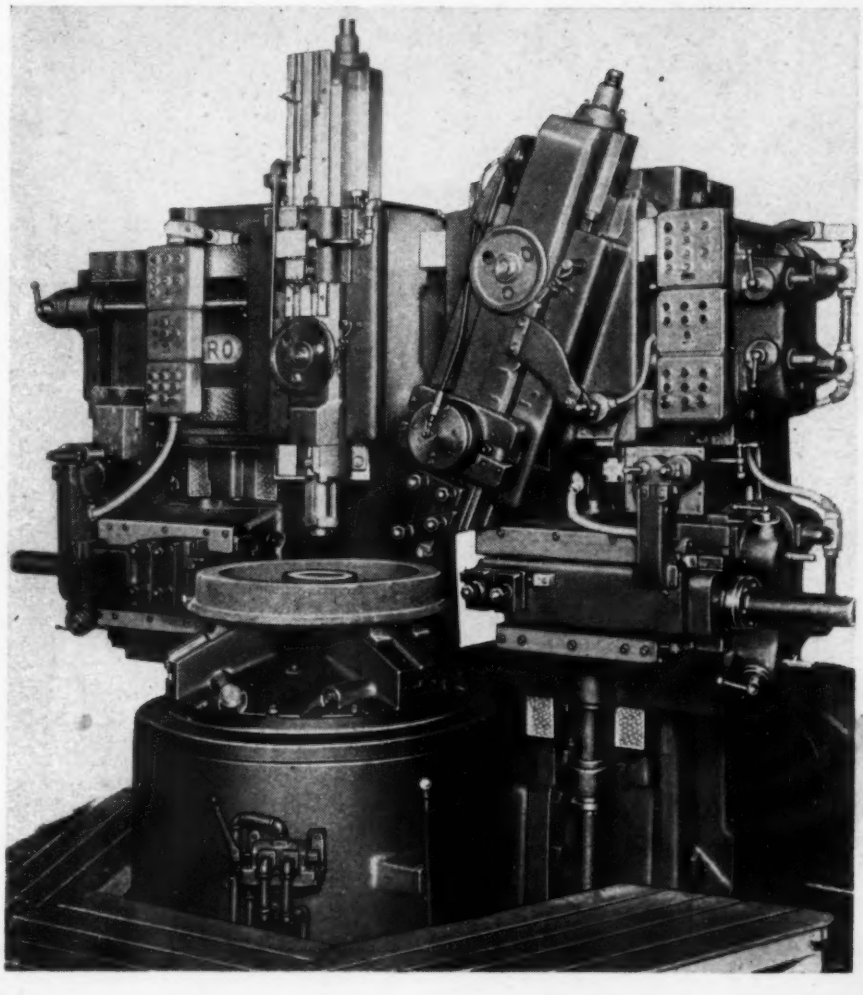
Four heads perform the operations. They are the boring and facing head, the rim-turning head, and two side heads. After the operator has moved the wheel into position with a hoist mounted on the top of the machine, he moves the control lever and the chuck jaws are hydraulically operated.

The automatic start button is then pressed and four heads traverse in to contact the wheel, change to feed rate for the turning and boring operation, then return to the starting position. Carbide tools with high negative rake are used on the turning operations, with high-speed steel for the boring and facing.

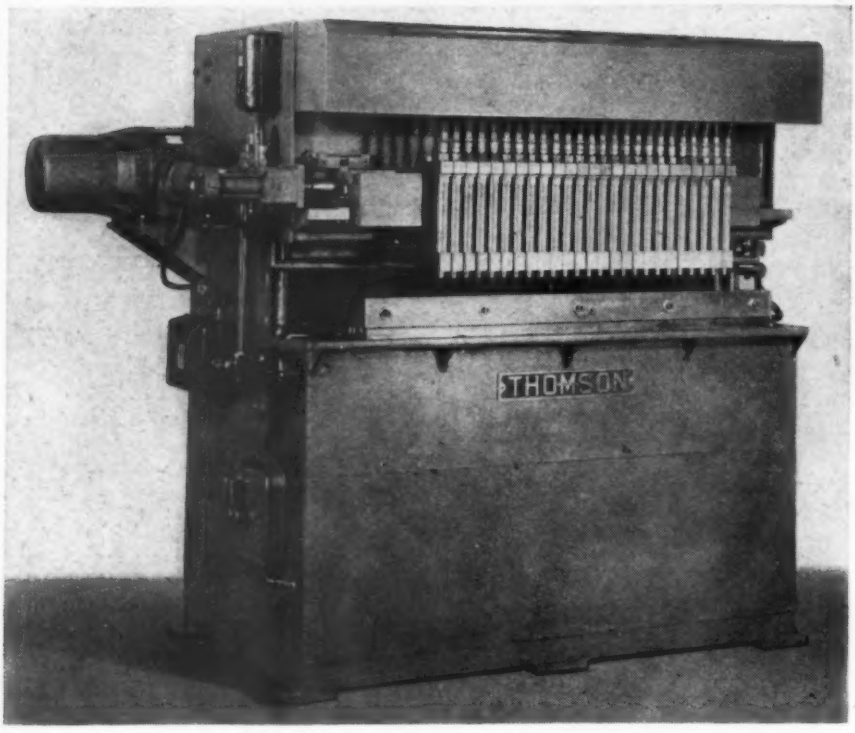
The 100-hp. main drive motor provides a table speed of 5 to 25 rpm. Thymatrol motors which are electronically controlled and screw operated are used on the boring and rim-turning heads. Electronic controls are used throughout the machine. All gears and shafts are mounted in preloaded anti-friction bearings.

The standard machine handles wheel sizes from 33 to 40½ in., but can be furnished for other wheel diameters. Both side heads include General Electric contouring attachments which provide the taper and contour on the tread and flange of the wheel. Motors with electronic controls are mounted individually on the heads to provide traverse and feed motions.

All cuts are generated which is said to provide finer finishes and greater accuracy than obtained with previous models in which the plunge cut method was used. The result is said to be longer wheel life with less maintenance costs.



Thomson Wire Mesh Spot Welder Will Weld Diagonal Wire Weave



On this model of the Thomson welder for wire mesh, 25 electrodes are arranged to weld a minimum width of 48 in.

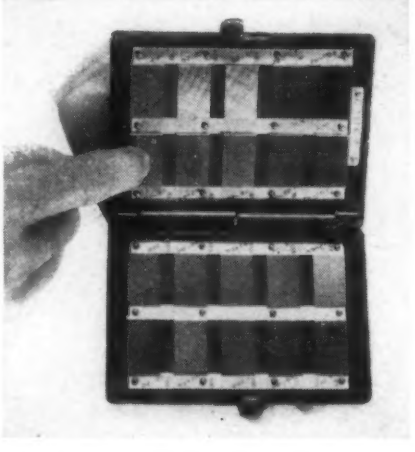
Designed for welding wire mesh for grills, racks and trays, and similar items, an "Ultra Speed" spot welder is announced by Thomson Electric Welder Co., Lynn, Mass. The normal capacity ranges from 14 to 14 gage minimum, to 0 to 0 gage maximum.

Longitudinal wires can be fed through the machine continuously if desired. Spacing between welds can be varied from a minimum of 1½ in. between welds, up. To handle welds in a diamond mesh or diagonal weave, a shuttle bar moves the entire bank of electrodes right or left of the initial position. This is actuated by a hydraulic cylinder.

Two 50-kva. transformers with individual heat regulators provide the welding current. Welding pressure is applied by a motor-driven hydraulic pump. Pressure is applied simultaneously to all electrodes and maintained during the cycle. Pressure and current dwell are adjustable for each electrode so different gages of wire can be used.

When the cycle is started the two sections of the carriage driven by a worm and reversing motor move across the machine, each firing half the electrodes. A solenoid brake automatically stops rotation of the driving motor at the limit of travel and electrode pressure is released. On the next cycle the carriage moves in the opposite direction.

Pocket Set of Surface Standards Is Compared with Finish of Work

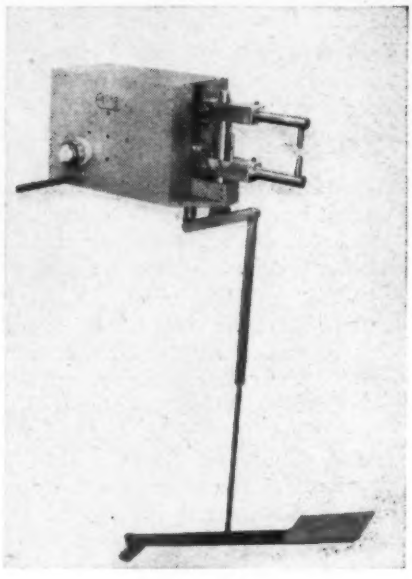


A pocket set of standards for checking surface finishes which conforms to the "preferred-number" series of the American Standards Association, is announced by University Machine Co. Div. of Baird Associates, Cambridge, Mass.

The set consists of 20 small blocks of stainless steel, each of which is machined to the surface finish specified for one of the standards. Finish of a part can be checked by drawing the finger nails across the specimen and across the standard.

The standards are held in a Dowmetal case with the microinch reading and method of cut shown for each block. The set is designated University Type 7.

Acro 3-kva., 110-v. Spot Welder Has Squeeze, Weld, Hold Action

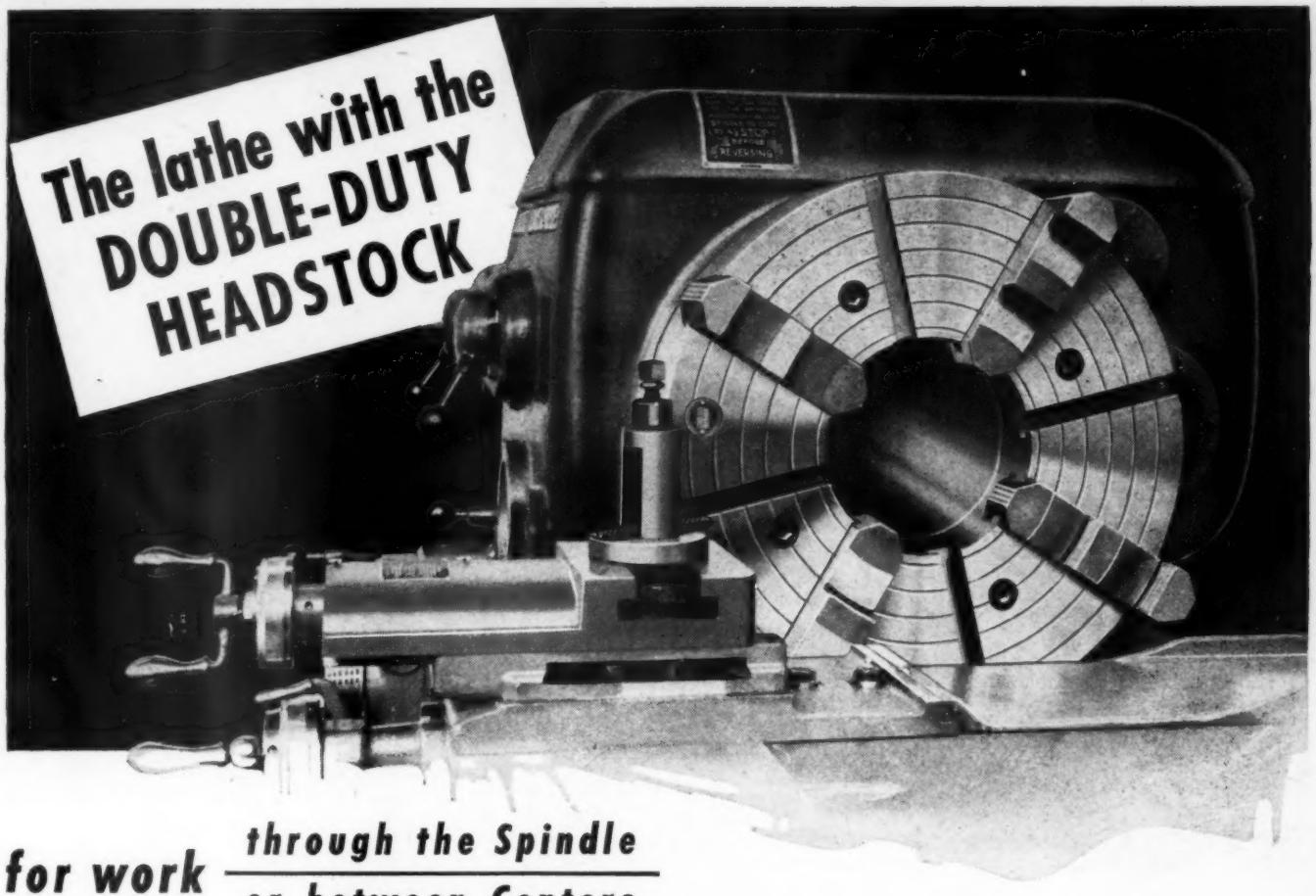


A spot-welder of 3-kva. capacity is produced by Acro Welder Mfg. Co., Inc., 1831 W. St. Paul Ave., Milwaukee, Wis. The transformer operates on a 110-volt, 60-cycle, single-phase current. High, medium, and low positions are provided.

During the first part of the stroke, the pivot point is on the back end of the short operating lever directly under the frame of the welder. After the points have come into contact on the work to be welded, the pivot point shifts to the center of the operating lever and causes the back of the lever assembly to move in toward the welding transformer, initiating the primary of the welding transformer. When pedal pressure is released, the current is broken first and then the welding points are allowed to open. This gives in effect simulated squeeze, weld, and hold periods.

The machine with pedal and cord weighs 103 lb.

The lathe with the DOUBLE-DUTY HEADSTOCK

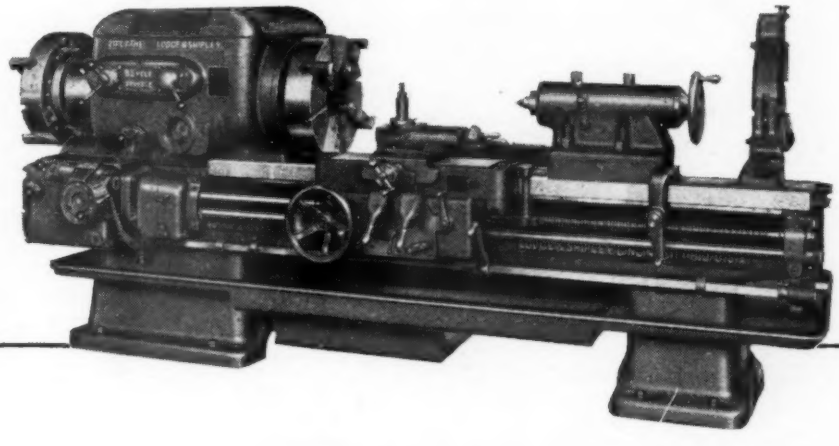


for work *through the Spindle* / *or between Centers*

● This Lodge and Shipley 20 inch Lathe with 8 9/16" hole through spindle has been developed for those jobs beyond the capacity of the standard lathe.

With headstock collet and center, the lathe can be used for regular between centers work . . . with headstock collet and center removed, work not to exceed 8 9/16" in diameter can be arranged through spindle, utilizing chucks at both ends.

You may have any number of jobs for which this lathe is the practical and economical answer. Why not call in Lodge and Shipley Engineers to discuss with you the suitability of this lathe for your work? There is no obligation. For additional details, write on your company letterhead for Bulletins 616 and 625.

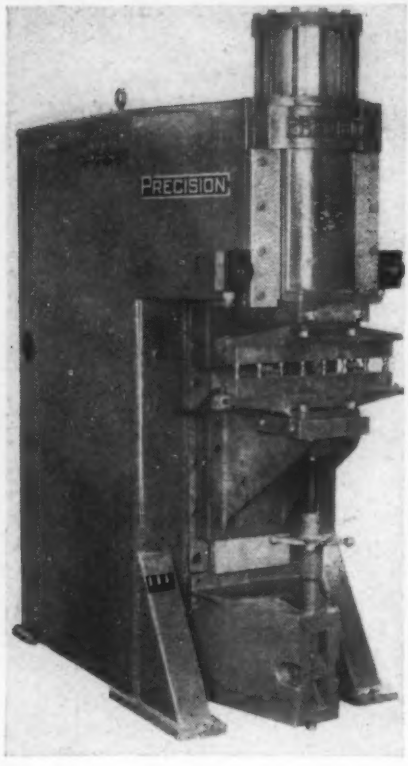


● *Illustrated is the 20" Hollow Spindle Lathe. Has all the features of the famous Lodge & Shipley Engine Lathe plus 8 9/16" Hole in Spindle. Other Hollow Spindle Lathes in 25, 27 and 30 inch sizes available with 12½" Hole in Spindle.*

ENGINE
TOOL ROOM
MANUFACTURING
OIL COUNTRY
DUOMATIC (AUTOMATIC) LATHES

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI 25, OHIO, U. S. A.
MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.

Precision's Spot Welders Range from 30 to 500 kva.



A series of air vertical action spot and projection welders, Type AVA, is announced by Precision Welder and Machine Co., 138 E. McMicken St., Cincinnati 10, Ohio.

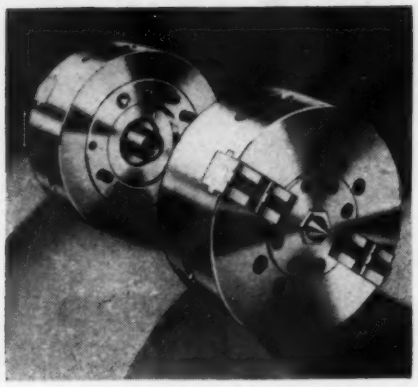
These press-type welders are made in four sizes from 30 kva. to 500 kva., with pressure to a maximum of 18,000 lb. The machines are constructed with unit assemblies and so that the interior is completely accessible.

The honed brass air cylinders are cushioned and have universal connection to the ram. Coolant flow is visible and readily accessible for adjustment. The ram rides on V-ways shrouded at the top for protection from dirt. Gibs provide adjustment for wear.

Solenoid valve can be removed from the air-terminal unit assembly without disconnecting the piping.

Skinner Compensating Chuck Forged with Alloy Steel Parts

A two-jaw compensating power chuck, Series 23100-A, designed to drive work on centers where exceptionally heavy cuts are being taken with carbide-tipped tools at high spindle speeds, is announced by the Skinner Chuck Co., 344 Church St., New Britain, Conn.



The center is of high-speed steel and fits a standard Morse Taper hole in the center plate. It can be removed by removing a thin nut threaded on the maximum diameter of the taper. The center plate is made of hardened alloy steel and is attached to the chuck body by six screws.

Compensating action of the jaws, which is sufficient for gripping rough-forged or cast surfaces, is provided by a rocker attached to a plunger. The body is a thick, solid, 1-piece steel forging. The jaws and all internal parts are made of alloy steels. The two "floating" jaws are of the non-adjustable type.

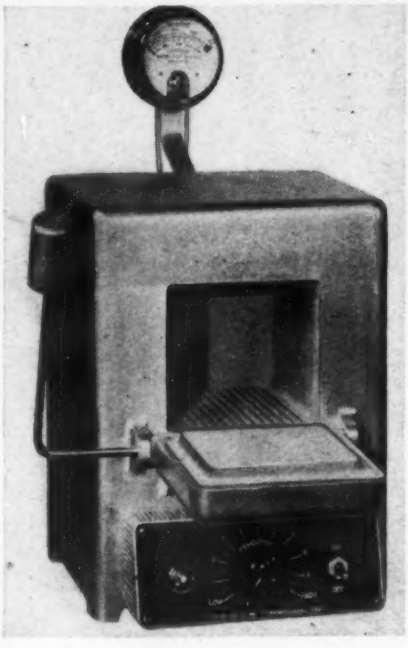
Dustkop Collector Improved For Buffing, Polishing Use

Several improvements have been made in the Model 1150 Dustkop dust collector made by Aget-Detroit Co., First National Bldg., Ann Arbor, Mich.

A high compression filter, a new filter seal, and cyclone stack deflector have been added. The changes are designed to meet the dust loads encountered in production buffing and polishing work.

The high-compression filter stops particles of lint and polishing dust at its surface, rather than permitting partial entry into the filter. This lint and dust forms a mat on the underside of the filter which can be removed, when it fills up enough to reduce suction, by lifting up one end of the filter assembly and simply stripping off the mat of lint.

Thermo Electric Small Furnace Has Range from 50 to 2000 F.



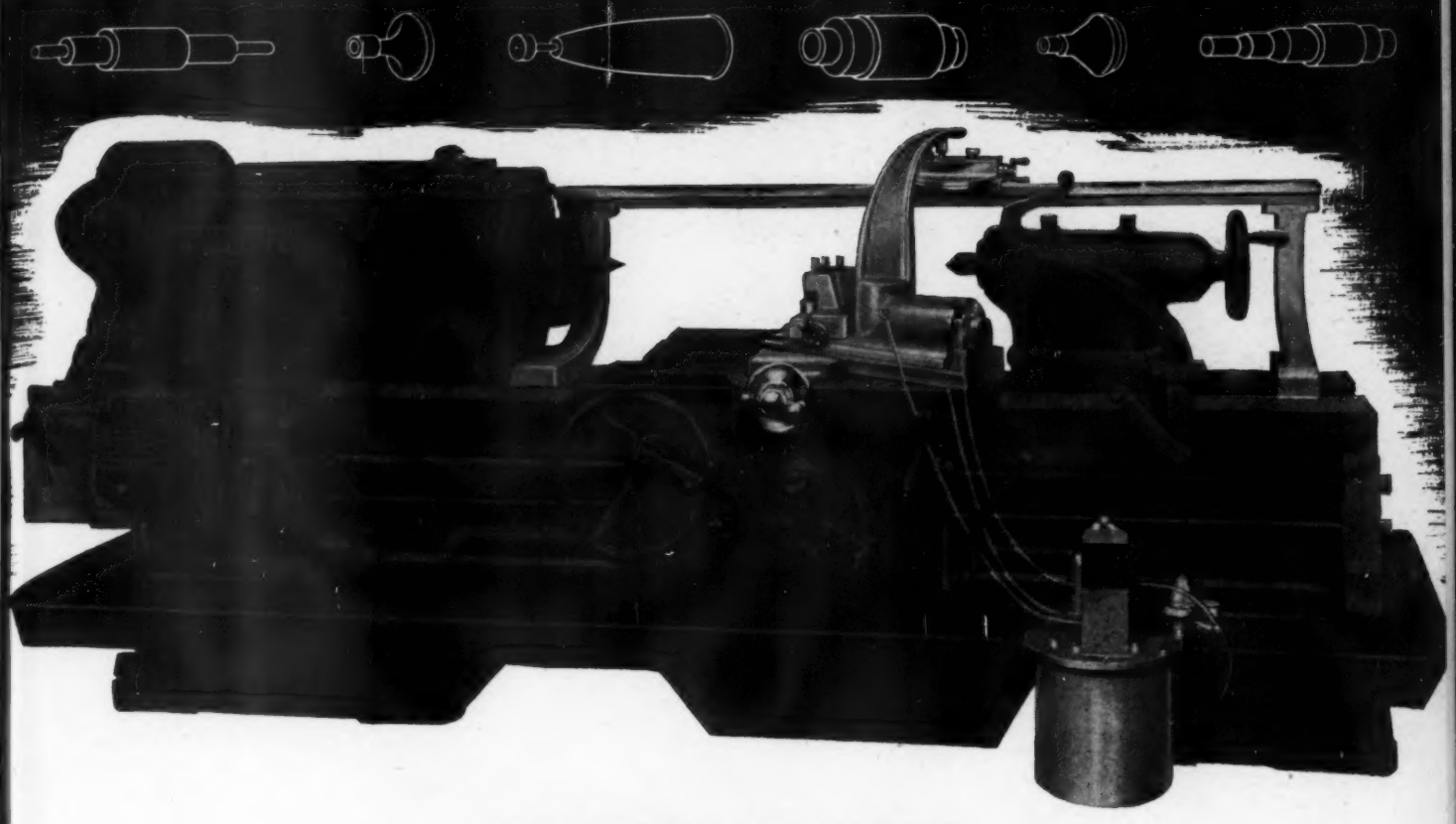
An electric furnace, Model CEA, for production heat-treating of small parts or general laboratory use, is announced by Thermo Electric Mfg. Co., 480 W. Locust St., Dubuque, Iowa.

The heating chamber is 4¾ in. wide, 4½ in. high, and 6 in. deep. Any temperature from 500 to 2,000 F. can be held. A one-piece aluminum casting is used for the body, and another for the door. The furnace is available for either ac. or dc. current at 115 or 230 volts.

Acromark 1F Stamping Machine Has Improved Pressure System

Improvements have been made in the Model 1F nameplate stamping machine made by the Acromark Co., 7-13 Morrell St., Elizabeth 4, N. J. A multiple lever and cam foot pressure arrangement is used which increases the foot power six to eight

FOR TURNING CONTOURS AND STEP SHAFTS



THE NEW EXCLUSIVE

MONARCH "AIR-TRACER"

FORMERLY KNOWN AS THE BAILEY DUPLICATING ATTACHMENT

Stepless increasing contours—machined to correspond to the template within a limit of tenths—and with a continuous finish that often eliminates subsequent grinding operations!

That's the kind of work you can do—*and faster*—with a new Monarch "AIR-TRACER" equipped lathe. You'll get greater precision—*greater production*—on increasing contours and on step shaft work, too. (Automatic sizing is an important integral feature.)

The "AIR-TRACER" has a proved production record for saving time, money and material on such diversified work as mandrels, punches, dies, nozzles, spinning chucks, impellers, valves, metering pins, molds—*and a wide range of step shafts.*

If you're doing these classes of work, you'll want to know all about the new Monarch "AIR-TRACER", offered exclusively on new Monarch Turning Machines equipped at the factory. You can get complete, detailed information in Bulletin 2601. Ask for your copy.

Check these advantages

- ★ **Stepless cutting-tool motion—*for increasing contours and a superior continuous finish.***
- ★ **Air-gage sensitivity combined with hydraulic power's versatility and ease of control—*an exclusive Monarch feature.***
- ★ **Automatic sizing eliminates repetitive setups and measurements—*for faster production, fewer rejects.***
- ★ **Continuous feed of slide on increasing diameters—*for more uniformly high finishes.***
- ★ **Exact conformance to template contours—*changes in template shape translated instantly into slide movement.***
- ★ **Feed infinitely variable from 0 to 20" per minute—*for maximum machining efficiency on all materials and diameters.***

THE MONARCH MACHINE TOOL CO.

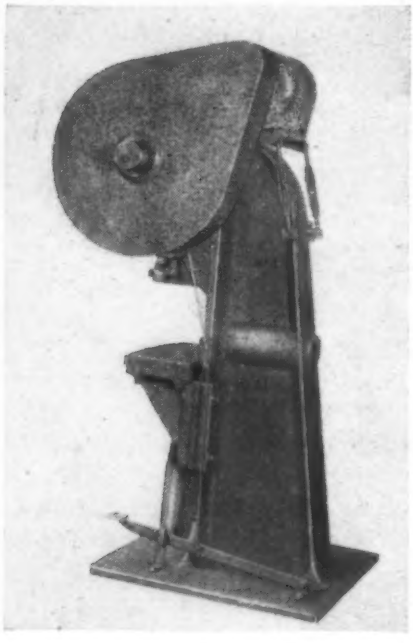
Sidney, Ohio

Monarch TURNING MACHINES

times over the previous Acromarker.

Character spacing adjustment can now be made when changing the lettering and numbering head by loosening a wing nut, and thickness adjustment can be made with a single screw. The pedestal has been enlarged to increase stability.

Improved Walsh Horn Press Has Motor Mounted at Top

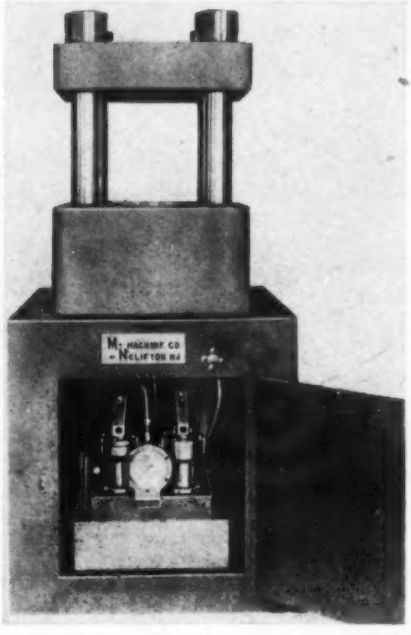


An improved version of the No. 3 Horn Press is announced by the Walsh Press and Die Division, American Machine and Gage Co., 4743 W. Kinzie St., Chicago, Ill.

The motor is mounted on top of the press, eliminating the jutting platform at the rear. A shield completely protects employees from the motor, pulley, drive-belt, and flywheel.

The switch box has been mounted on the main frame within easy reach of the operator. A large circular clamp assures positive clamping of the die shaft onto the slide or ram.

200-ton Hydraulic Hobbing Press Has Double-cylinder Hand Pump



The Model M13A hydraulic hobbing press made by the M. & N. Machine and Tool Works, 146 Orono St., Clifton, N. J., is intended for hobbing cavities for rubber and plastic molds, or for jewelry dies. It is a 200-ton capacity hand-pump press.

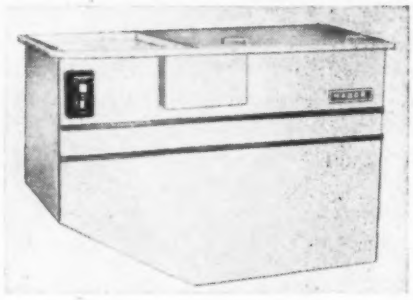
The ram diameter is 13 in. and stroke is 4½ in. The opening left to right is 11 in. and front to back 18 in. The pump is of double-cylinder design providing up to 6,000 psi.

Changes Simplify Maintenance In Sylvania Fluorescent Units

Two design changes have been made in fluorescent fixtures to simplify maintenance, it is announced by Sylvania Electric Products, Inc., Salem, Mass. Commercial fixtures now have the ballasts fastened to the top-housing with self-tapping "Z" screws which make it possible to remove the ballasts without removing the top housing from the ceiling.

Double length industrial fixtures, Models HFF-208 and HFF-308, have the starters relocated at a center position between the two reflectors on the underside of the tophousing. This permits servicing the entire group at once and makes starters less subject to moisture and dust.

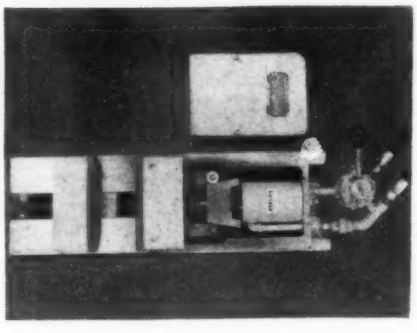
Mabor Dip-agitating Machine Has Removable Drive Mechanism



A dip-agitating machine with the drive mechanism mounted in a removable frame has been developed by Mabor Co., Box 77, Route 3, Rahway, N. J. The weight of the parts is balanced by means of a knee which rests next to the bottom of the equipment, outside the tank.

The machine is built in a variety of sizes and can be heated with steam, gas, oil, or electricity.

Airlox Senior Vise Convertible To Hydraulic Operating Method



The three large sizes of Airlox Senior vises are now produced in a hydraulic adaptation by Production Devices, Inc., Whitehall, N. Y. When mounted on a machine tool, hydraulic line pressure is taken from the hydraulic pump of the machine.

The vise illustrated shows the hydraulic cylinder and valve, with the piping arrangement that is used. The wedge and lever linkage are identical with the pneumatic vise. The vise operates on 600 lb. of oil pressure, delivering a 10,000 lb. squeeze at the jaw. The hydraulic cylinder is interchangeable with the air cylinder in size, so that it can be installed in existing vises.

EASIEST OF ALL SHEARS TO OPERATE

"EASIEST of all Shears to operate" are not just our words. They are words of operators being heard with increasing frequency as more Steelweld Shears are placed in plants throughout the country.

Men who have worked for many years on shears of various makes and know them through and through are acclaiming the many features incorporated into Steelwelds — features that ease their work, speed production and make for greater accuracy and minimum maintenance.

Steelweld Shears are entirely new machines designed from scratch as such. They are not a variation of or an adaptation to any previously existing machine. The designers of these new shears were free to incorporate all ideas and features that would result in better machines. They were not hampered by tradition or previous designs or models.

As a result Steelweld Shears are radically different with advantages never before possible.

Whether or not you are in need of a shear at this time, if you work plate in any thickness up to 1¼-inch or length to 18 feet, we urge you to get more data on these modern machines. Keep informed — send for the catalog below.

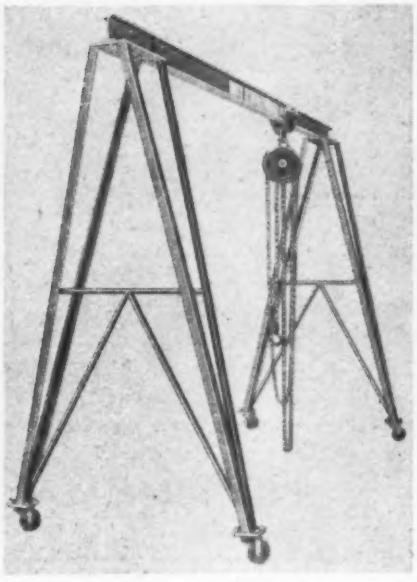
GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1127 EAST 283RD ST. WICKLIFFE, OHIO.

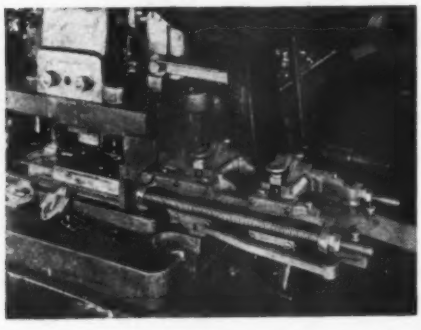
STEELWELD PIVOTED BLADE SHEARS



Portable Crane

This Gantry crane with 1-ton capacity is made by the Industrial Equipment Co., 315 N. Ada St., Chicago 7, Ill. Designed for ease in handling, the crane is said to have generous safety factor.

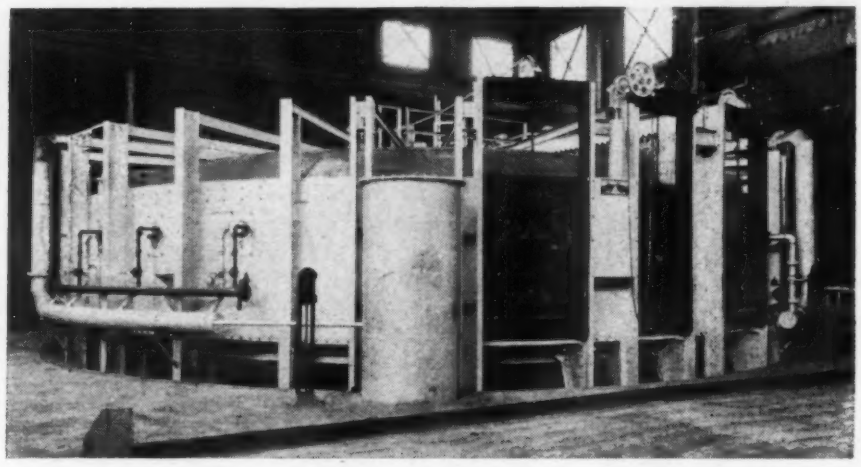
Dickerman Punch Press Feeds Feed Up to 6 in. Per Stroke



Two punch press feeds each having a feed length of 6 in. on presses with a stroke of 3 in. or more are produced by H. E. Dickerman Mfg. Co., 321 Albany St., Springfield, Mass. On presses with a stroke less than 3 in., the feed is approximately twice the stroke.

One size feeds coiled strips in thicknesses up to 3/16 in. and widths up to 4 in. The other feeds coiled strips in thicknesses up to 3/16 in. and widths up to 6 in. The feed lengths are adjustable from 0 to the maximum in increments of 0.001 in. The new punch press feeds retain the features of previous 3-in. Dickerman die feed. They can be placed on the die set or bolster plate in any position for any style die. They require no connection to the power shaft.

Rust Doughnut-shaped Furnace Eliminates Waste Gas Vents



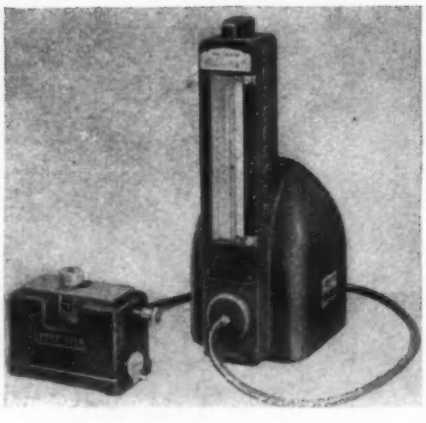
This doughnut-shaped rotary furnace for railroad car axles uses the counterflow heating principle

A doughnut-shaped rotary furnace in which the counterflow principle of heating is used, has been built by Rust Furnace Co., Pittsburgh, Pa.

In previous models burners about the periphery supplied heat while waste gases were dissipated through vents in the wall. In the improved design, a stack has been added with waste gas outlets located on the outer and inner circumference of the furnace, near the charging door. The vents have been eliminated, and waste gases circulate over the moving hearth entirely around the circumference to the outlet. A damper, with automatic control, is located in the flues between the furnace and stack to control the process.

The improvement is said to cut fuel consumption in half, and result in more comfortable working conditions in the center area of the furnace.

Sheffield Internal Precisionaire Is for Inspecting Master Gages



A Precisionaire internal measuring instrument for the accurate checking of small rings from 5/32- to 1-in. internal diameter has been developed by Sheffield Corp., Dayton 1, Ohio. The rings may be explored to a depth of 9/16 in. from each side by means of vertical adjustment of the diamond-tipped gaging arm which can be made with a handwheel.

Gage blocks are used in setting the instrument which has an amplification of approximately 35,000 to 1. Deviations of five millionths of an inch are represented by 0.175 in. on the scale.

The instrument is designed for the gage control room where master, inspection, and working gages must be checked. The relatively inexperienced operator is said to be able to adjust the ring on the gaging fingers so that the float indicates the true diameter.

Danielson Nylon Soft Hammer Made in 2/3- and 2-lb. Size

A soft hammer with faces of nylon is produced by the Danielson Mfg. Co., Danielson, Conn. It is now available in 2/3- and 2-lb. sizes.

The replaceable nylon faces are said not to chip or mushroom, and to resist fire, chemicals and oils.

DIE COSTS TAKE A NOSE DIVE

Typical examples of set-ups made from stock units. No delay in starting production.

All there is to Whistler punch and die units.

WHISTLER Adjustable Perforating Dies Offer Added Production Economy

5-10-50 and even more different set-ups with the same dies? Impossible? Not when you use Whistler Multi-Use Adjustable Dies. For it's simple to rearrange these units . . . add or delete . . . get back into production within a few hours. Even so-called complicated arrangements are easy to set up. And, with first cost invariably less than for single purpose dies, this continued re-use of the same dies effects added economy in quickly writing off initial die investment. Over 750 prominent manufacturers have proven in their own plants that Whistler Adjustable Dies have sent costs into a nose dive.

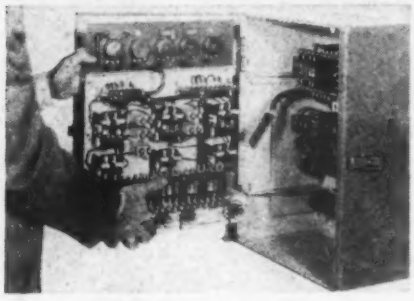
No special tools are needed. Work in practically any size and type of press. Ordering now is particularly advantageous. Large stocks of standard diameter units from 1/32" up are available for overnight shipments. Notching, group dies and special shapes and sizes can be quickly made to order. Write today to:

WRITE FOR YOUR WHISTLER CATALOGS. Know the production advantages of Whistler Adjustable Dies.

S. B. WHISTLER & SONS, INC.

752-756 MILITARY ROAD · BUFFALO 17, NEW YORK

General Electric Weld Timers Permit Short Timing Intervals



The line of sequence and sequence-weld timers produced by the Control Div. of General Electric Co., Schenectady, N. Y., has been completely redesigned. The new design includes an improved electronic timing circuit to permit consistent welding speed with short timing intervals.

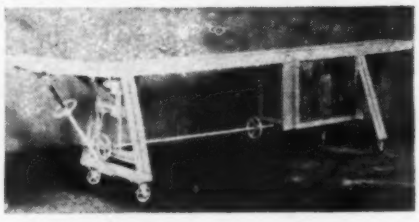
The sequence timer is used where the highest degree of consistency is required, and coordinates the mechanical operation of an air- or fluid-operated welder with the flow of welding current, as determined by a synchronous-precision weld timer.

When less exacting timing is possible, the sequence-weld timer provides control of both the mechanical sequence of operation and non-synchronous control of weld time.

Electrical connections between front and rear panels are made by plug connectors so that the front panel, which is the timing control section, can be removed and placed in another machine.

The wiring system is redesigned to simplify routine inspection and servicing. Most of the small resistors and capacitors are now mounted on a terminal board.

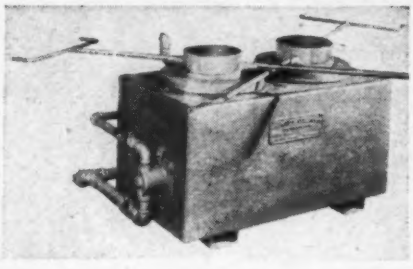
Island Equipment's Conveyor Takes Hot Work from Extruder



A conveyor which is designed to carry material from extruders, permitting it to cool for safe handling, is announced by Island Equipment Corp., 101 Park Ave., New York 17, N. Y.

The conveyor has three control handwheels, one of which is used to adjust the height of the infeed section to the outlet of the extruder. The other two handwheels are to control the speed of the belt. These are located so that one will always be near the operator to adjust belt speed to the rate of extrusion.

Kindt-Collins Melting Furnace For 50 or 100 lb. of Aluminum



An aluminum melting furnace of 50 or 100-lb. capacity has been announced by the Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11, Ohio. The unit can be gas or oil fired.

The aluminum can be melted in and poured directly from the alloy metal pot which, with reasonable care, will withstand more than 100 heats.

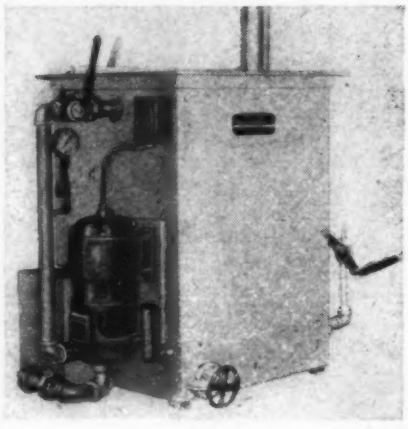
Available in single or double units, the furnaces are pilot equipped. They can be used for occasional melting of brass.

Look, No Pallet

Light, bulky cartons are handled without pallet or skid by an industrial truck designed by Automatic Transportation Co., 149 W. 87th St., Chicago 20, Ill.

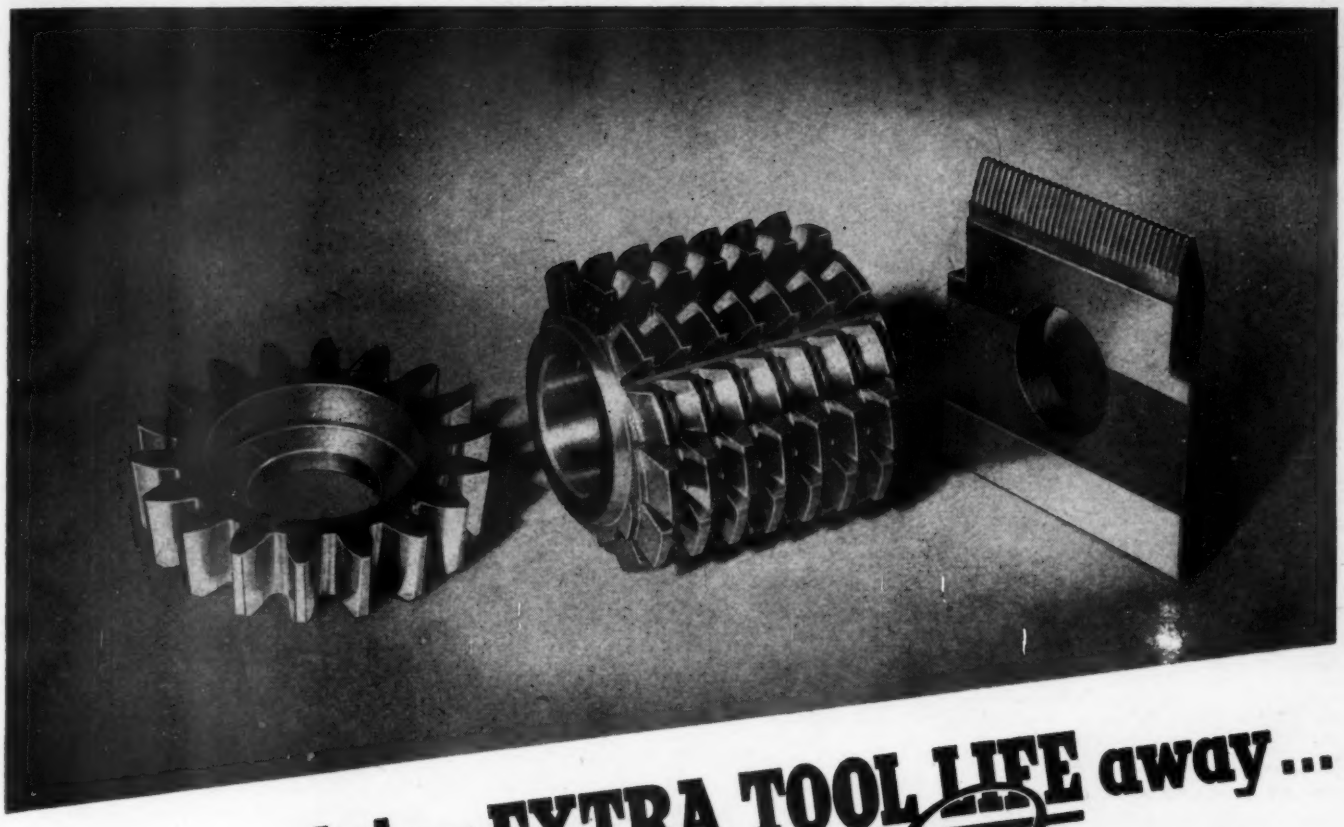
Hydraulic pincers replace the regular forks on the clamp truck. The clamping pads are adjustable in height to suit the loads and are mounted on a scissors-type frame. The load is clamped by spring action and is released by hydraulic pressure from the pump.

Optimus Spray-type Washer Will Handle Parts on Racks



A spray-type washing machine for handling parts on racks is announced by Optimus Equipment Co., 151 Church St., Matawan, N. J.

The unit can be placed directly on the floor in which position the top of the unit is at working height. Adjustable spray nozzles are actuated by a lever-operated valve. The machine can be used with submerged agitation to remove caked greases and abrasives.



We are giving EXTRA TOOL LIFE away ... . Free

That's not an idle claim. For instance, one tool engineer recently confided in us that he . . . "took one of your hobs and had another company copy it. They did—so exactly that you couldn't find the slightest difference under a comparator. The steel checked exactly as to analysis and hardness, too. But, when we put them on the job . . . not one of them did better than one-half the production of the Michigan hob!"

And remember this—

Michigan does not make just hobs or just shaper cutter or just gear cutting tools. We are interested in the gear from the forging to final assembly. That helps a lot when you are engineering gear cutting tools to any given job.

No Segregated Carbides

He is not the only one who has tried copying the design of engineered-for-the-job Michigan gear cutting tools. What they do not get is the freedom from carbide segregation in Michigan gear cutting tool steel.

Ask your metallurgist. He'll tell you that segregated carbides are points of weakness in any tool. Get rid of them and you get:

1. **Better heat treat results—stronger body and teeth—no weak spots.**
2. **Better sharpening—less chance of minute chips breaking out—less stock removal—more grinds per tool.**
3. **Smoother cutting action—no jagged edges.**
4. **More pieces per grind—cutting edges hold up longer.**

Have you seen Michigan's combined manual and catalog "Gears"? Ask for it on your company letterhead.

ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY

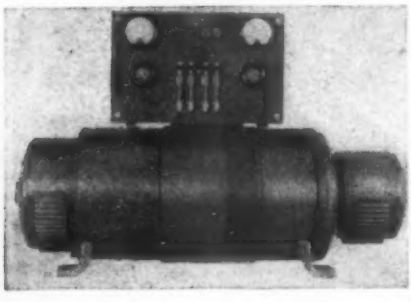
7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.

Thermador's Electric Heat Fan Is for Heating, Air Circulation

An industrial version of the Thermador Electric Heat Fan is announced by Thermador Electrical Mfg. Co., 5119 District Blvd., Los Angeles 22, Calif. It can be used for heating in winter and circulating air in summer.

The unit weighs 19½ lb. and is 19¼ in. high, 14¼ in. wide, and 18⅛ in. deep. It is available with thermostatic control or with a rotary 4-position switch. The unit operates on 230 volts.

Electroplating Generators Have Sparkless Commutation

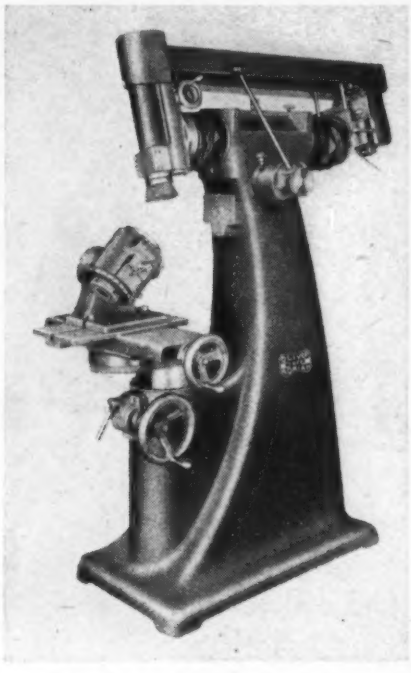


A line of low-voltage electroplating generators is announced by Motor Generator Corp., Troy, Ohio. Six models range in size from 100 amp. at 6 volts to 2,000 amp. at 6 volts, or 1,000 amp. at 12 volts.

The generator is a double commutator type, compound wound, and equipped with interpoles or commutating poles which insure sparkless commutation. Special metallic brushes are used to carry the high current. The generator fields are separately excited which is said to insure better plating characteristics.

The model illustrated is No. 130 which is rated at 1000 amp. at 6 volts, or 500 amp. at 12 volts. It is driven by a 10-hp. motor at 1200 rpm. It is normally used with a tank containing about 250 gallons of solution.

Oliver's Heavy-duty Grinder Is for Carbide-tipped Cutters



A heavy-duty model of the Ace tool and cutter grinder is announced by the Oliver Instrument Co., Adrian, Mich. The machine is essentially the same as the standard model, but has a heavier ram, larger ram bearing, a heavier motor, and a heavier spindle.

Designed for gumming and gashing cutters and for grinding cutters tipped with tungsten-carbide it uses the same type of fixtures as the standard model.

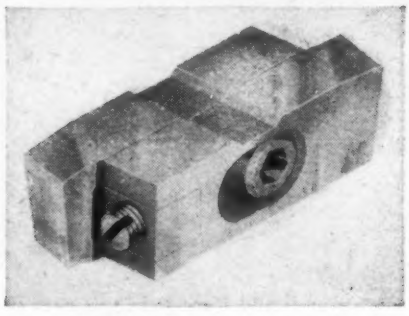
A fixed diamond compensates for wear of the wheel. Eccentric relief is ground on milling cutters and reamers with no special attachment required for grinding all regular and many special milling cutters.

B. F. Goodrich Spray-type Washer Lined with Acid-resistant Rubber

A spray-type machine for continuous pickling and washing of metal parts is announced by Industrial Products Sales Division of The B. F. Goodrich Co., Akron, Ohio. Units are individually designed to meet the requirements and are lined with acid-resistant rubber which is adhered to the metal wall by the Vulcalock process.

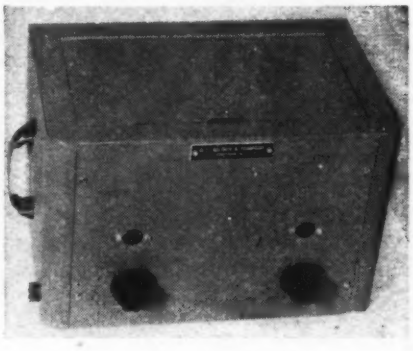
Pieces are fed on to a conveyor at the entrance to the machine and carried through the spraying and washing cycles automatically. The material will handle any size or shape within the over-all size limits of the unit. Acid-resisting rubber compounds are used for lining.

Madison's Rough Boring Tool Has Blades Form Cutting Block



A rough boring tool in which the cutter blades themselves form the cutting block, is produced by the Madison Mfg. Co., Spring and Bauer Sts., Muskegon, Mich. A single micrometer-thread screw expands both blades equally from the centering slot on the blades.

This arrangement is said to permit quick changing of cutters, adjustment of cutter size before mounting in bar and positive centering of cutter in bar. The cutter is automatically centered, equalizing the load on the cutting elements.

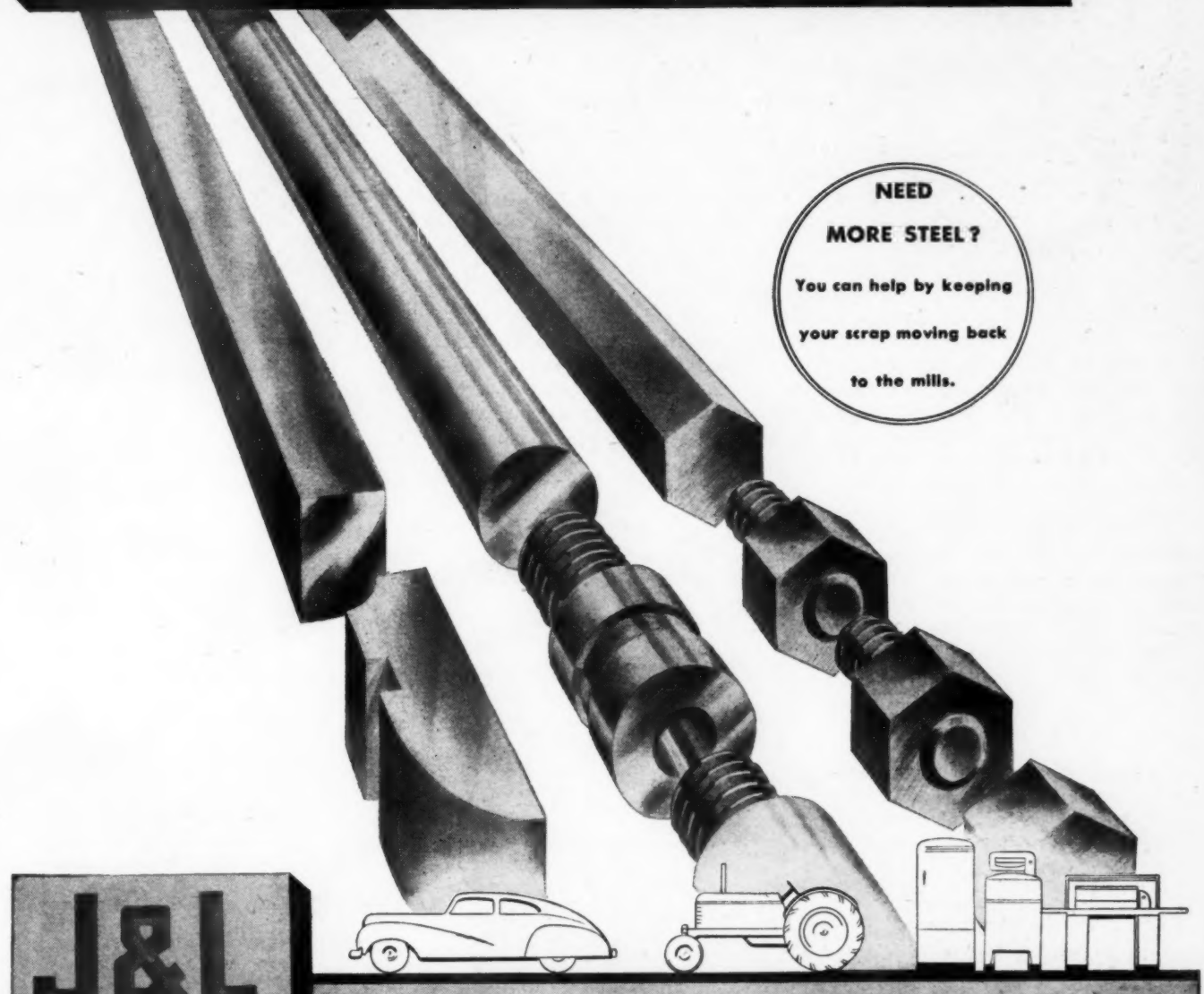


Strain Gage Amplifier

25,000 amplifications from 1 to 30 cycles is provided by this unit made by G. C. Wilson & Co., 2 N. Passaic Ave., Chatham, N. J. Used with a strain gage and cathode ray oscilloscope, it will provide a visual indication of vibration amplitude of 0.00001 in. Operating from standard 115-volt, 60-cycle current, the amplifier requires 150 watts.

J&L COLD FINISHED STEEL

FOR EASILY MACHINED · ACCURATE PARTS



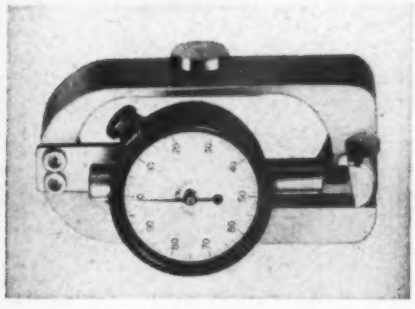
J&L STEEL

In addition to improved machinability and longer tool life obtained through use of J&L Cold Finished steel, many manufacturers specify this precision product for its improved surface finish. They also obtain in J&L cold drawn and cold rolled bars and special shapes the higher physical qualities needed for parts of modern high-speed machines. J&L engineers and metallurgists will be glad to assist you with your production problems. Write or phone your nearest J&L office.

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH, PA.

Parts and Materials

Dillon Compact Pressure Gages Range Up to 5000-lb. Capacity

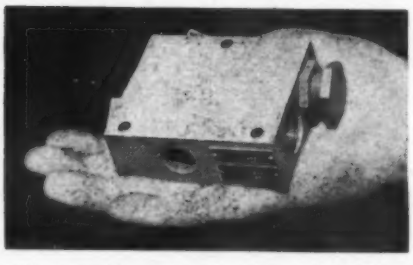


A series of mechanical pressure gages of compact design have been developed by W. C. Dillon & Co., Inc., 5410 West Harrison St., Chicago 44, Ill. Gages can be used to check pressure between spot-welding machine electrodes, plates in presses of all types, pressure between moving rollers, and in other applications.

The range in each model is from 0 to the upper limit. The 100-lb. model weighs 1¼ lb. and is 3⅝ x 27/32 x 1¾ in. The 250, 500 and 1000 lb. models weigh 2 lb. and are 4 5/16 x 2 7/16 x 2 5/16 in. The 2500- and 5000-lb. models weigh 2½ lb. and are 4⅝ x 2⅜ x 2¾ in. A 10,000-lb. model will soon be added to the line.

For locations where the operators cannot read the dials, remote repeater stages are provided which can be used up to 500 ft. from the pressure gage.

Electrol Hydraulic Valves Cut Out at 300 to 1500 psi.

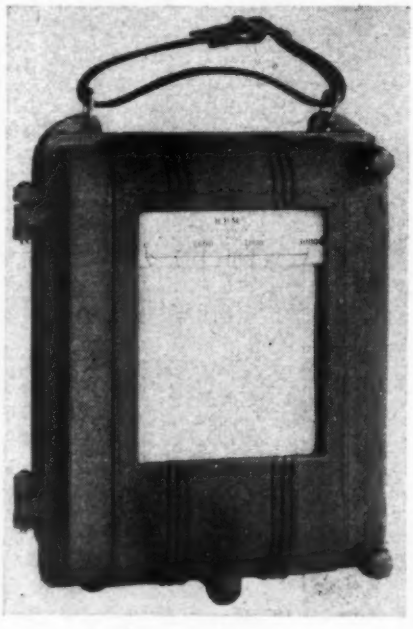


A hydraulic cut-out valve which has a compact housing only 1¼ in. deep is produced by Electrol, Inc., Kingston, N. Y.

Cut-out pressures can be supplied from 300 to 1500 psi., and differential pressure can be varied (in relation to the desired cut-out pressure) from 75 to 500 psi. The valves have an external adjustment to set pressure.

Enthone Alkali Cleaner Used on Active Metals

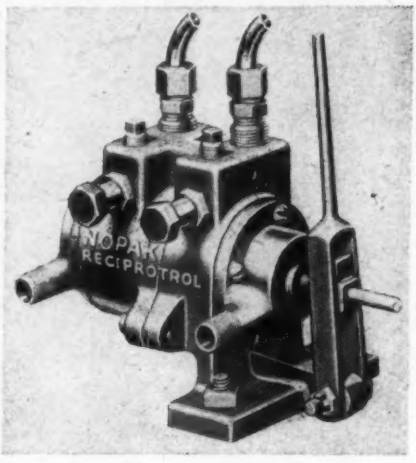
An alkali cleaner, Enthone Brass Cleaner, is announced by Enthone, Inc., 442 Elm Street, New Haven, Conn. The cleaner is said to have high detergent ability without tarnishing action on active metals including copper, brass, bronze, nickel silver, tin, and lead. It can be used as a general plating room cleaner for cleaning steel or other metals. It can also be used for soak or electrolytic cleaning, or scrub cleaning.



Tachometer Recorder

Inkless recorder provides a record of rotating speed and can be used with any ac. tachometer generator of suitable characteristics. Produced by Meter and Instrument Div., General Electric Co., Schenectady 5, N. Y., it has a scale range from 0 to 3,000 rpm. Readings are accurate to within 1.5% of full scale. Standard chart speed is 3 in. per hr. with a typewriter ribbon used for printing.

Cylinder Stroke in 2 Directions Set by Galland-Henning Valve



A valve which provides independent regulation of stroke speed in both directions in air cylinders, the Nopak Reciprotrol, has been introduced by the Galland-Henning Mfg. Co., Milwaukee, Wis. The four-way valve will operate any size or make of air cylinder at line pressures from 50 to 300 lb., air or hydraulic.

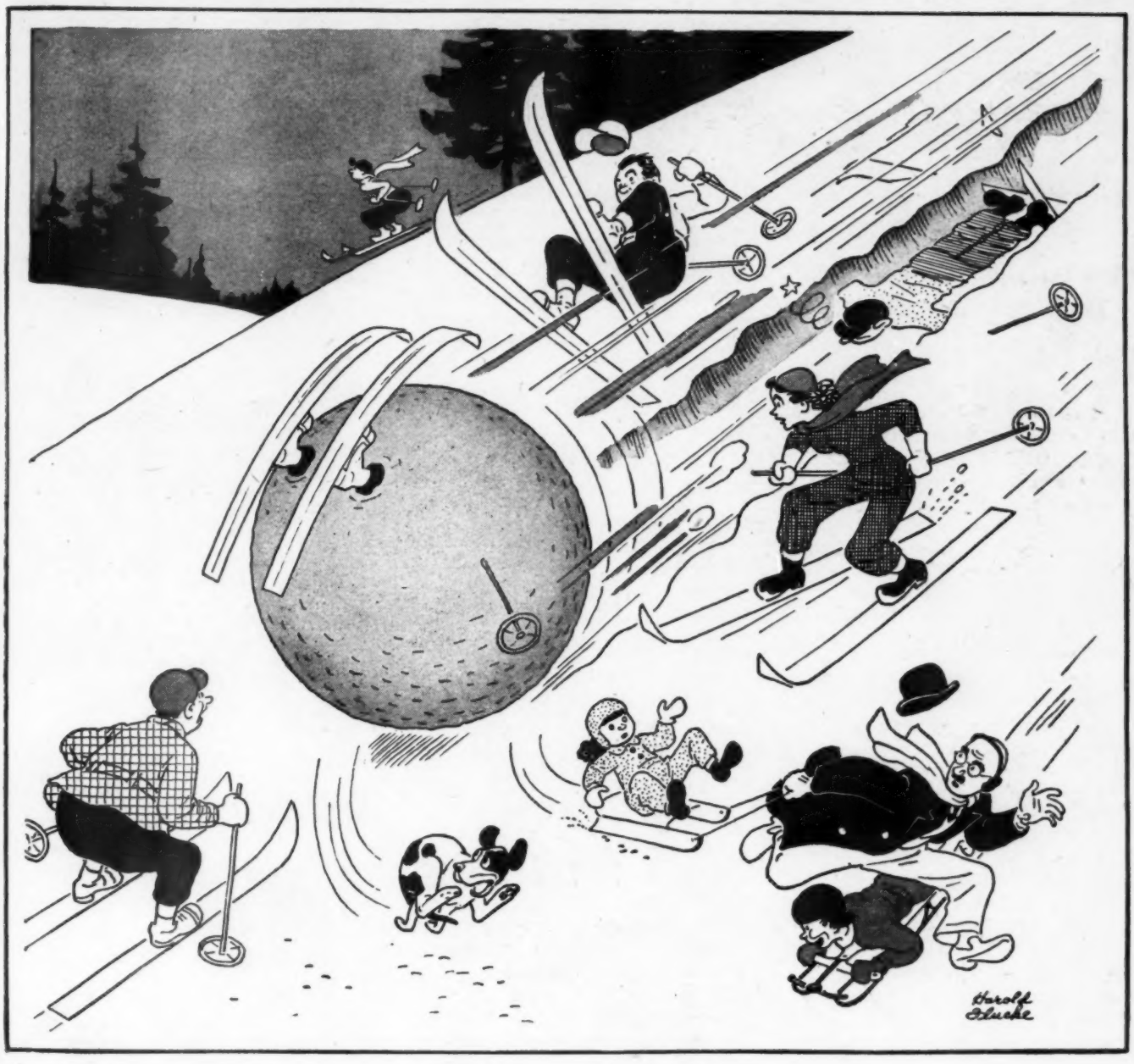
The length of stroke can be regulated, with fractional cylinder stroke located at any point within the stroke length. Up to 500 cycles per minute are possible on small cylinders.

The valve has ⅜-in. connections.

Eutectic Stainless Electrodes Arc for Low-temperature Use

Arc welding on stainless steel with alternating and direct current, is said to be performed at lower base metal temperatures with the new "Low-Temp" welding electrodes produced by Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.

These flux-coated metal-arc electrodes are produced in sizes from 3/64 to 3/16 in. in dia. Types available are 18/8 for welding stainless steel 301, 302, 303, 304, 308, 321, and 347; 25/12 for welding type 309, and for welding stainless clad steels; and 25/20 for welding type 310 and high-strength, low-alloy steels.



Nothing Rolls Like a Ball . . .

Johnny Ski-jump took a header in the wet snow. He's still in a complete whirl about it all, but he's demonstrating an important fact:

Nothing rolls like a ball.

That fact has been put to work in precision-finished, tough, forged steel...in New Departure *Ball* Bearings.

Because of their natural—and engineered—advantages, New Departure *Ball* Bearings are practically friction-free. They carry heavier loads at higher speeds. They assure rigidity and precise placement of moving parts. *continued*

New Departure *Ball* Bearings are born of a matchless fund of practical experience—and original thinking. Wide recognition of this has made New Departure the world's greatest ball bearing maker.

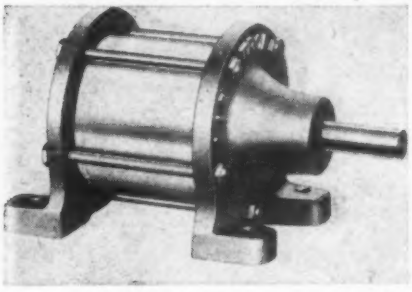
EVER WONDER ABOUT NAMES?

The name "New Departure" aptly describes that organization's brand of thinking. The many new departures by New Departure are stepping stones of engineering progress.

3426

NEW DEPARTURE • Division of General Motors • BRISTOL, CONN. • Branches in DETROIT • CHICAGO • LOS ANGELES and Other Principal Cities

Air-Trol Line of Cylinders Have a 1.76 Power Factor



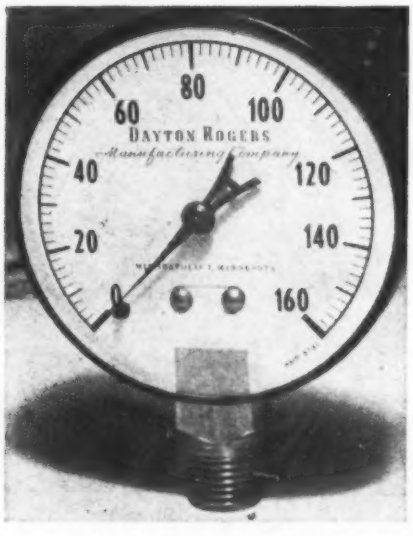
A line of air cylinders in sizes of 1½ in. and up is announced by Air-Trol, 2651 W. Lake St., Chicago 12, Ill. The cylinders have a power factor from 1.76 times air line pressure. Cylinders have bronze ram bushings which are graphite impregnated. Foot control is available.

Smith Die-casting Lubricant Stops Forming of Zinc Oxide

A new die-casting lubricant, Die Slick No. 11 has been developed by G. W. Smith & Sons, 5400 Kemp Road, Dayton 3, Ohio. This colorless, odorless compound is applied as a mist spray to the die.

The lubricant prevents formation of zinc oxide on the core pins and die cavities and is said to eliminate scoring and sticking. Use of the lubricant does not prevent subsequent plating of the casting.

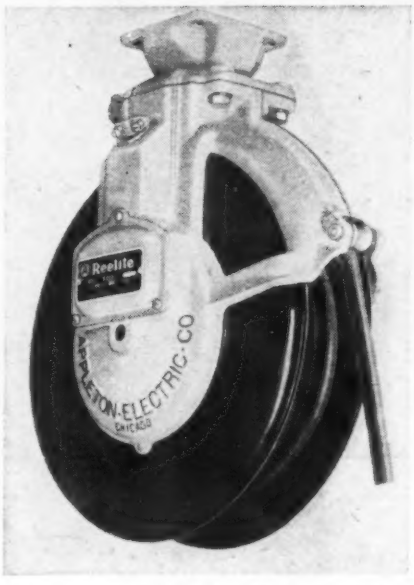
Dayton Rogers Pressure Gages Are Suited for Liquid or Gas



A new line of pressure gages with a convex, non-breakable crystal is announced by The Dayton Rogers Mfg. Co., 2835 12th Ave., S., Minneapolis 7, Minn.

The unit is of the Bourdon approved type and is suitable for liquid or gas. Movement or distortion of the pressed steel case is said not to affect the accuracy or reading of the dial.

Appleton Electric Cable Reel Works with Traveling Hoists



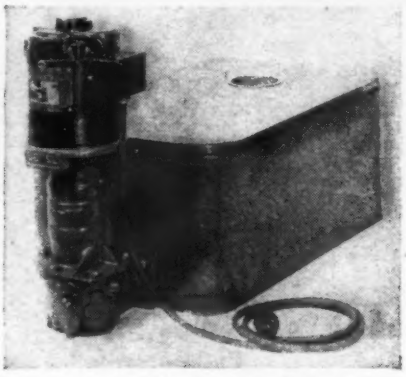
A reel for electric cable especially designed for use with traveling hoists is announced by Appleton Electric Co., 1701-59 Wellington Ave., Chicago 13, Ill. Designed Type "YS" Reelite, it has no exposed current collectors, trolleys, or wires. The reel automatically takes up and pays out cable for any traveling electric hoist within its rated capacity. For serving curved track and certain straight track installations, it is furnished with swivel base which permits rotation up to 335°.

Eutectic Silver Welding Alloy Will Bond at 940 to 1120 F.

A silver welding alloy for high-strength welds on ferrous and non-ferrous metals, EutecRod 1801, is announced by Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.

The alloy is applied by torch, furnace, or induction heating equipment. It bonds at base metal temperatures 940 to 1120 F. and melts at 1443 F. At this temperature, it is said to flow freely into close-fitting joints because of its high capillary action. Weld deposits are said to have a shear strength of 120,000 psi., good corrosion resistance, and good electrical conductivity. The alloy is available in rods, wire, strip, and powder form.

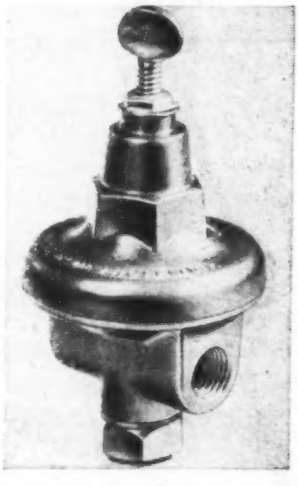
Delta 30-gpm. Coolant Pump Has Totally Inclosed Motor



A coolant pump which will deliver up to 30 gpm. at low heads is announced by Delta Manufacturing Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1, Wis.

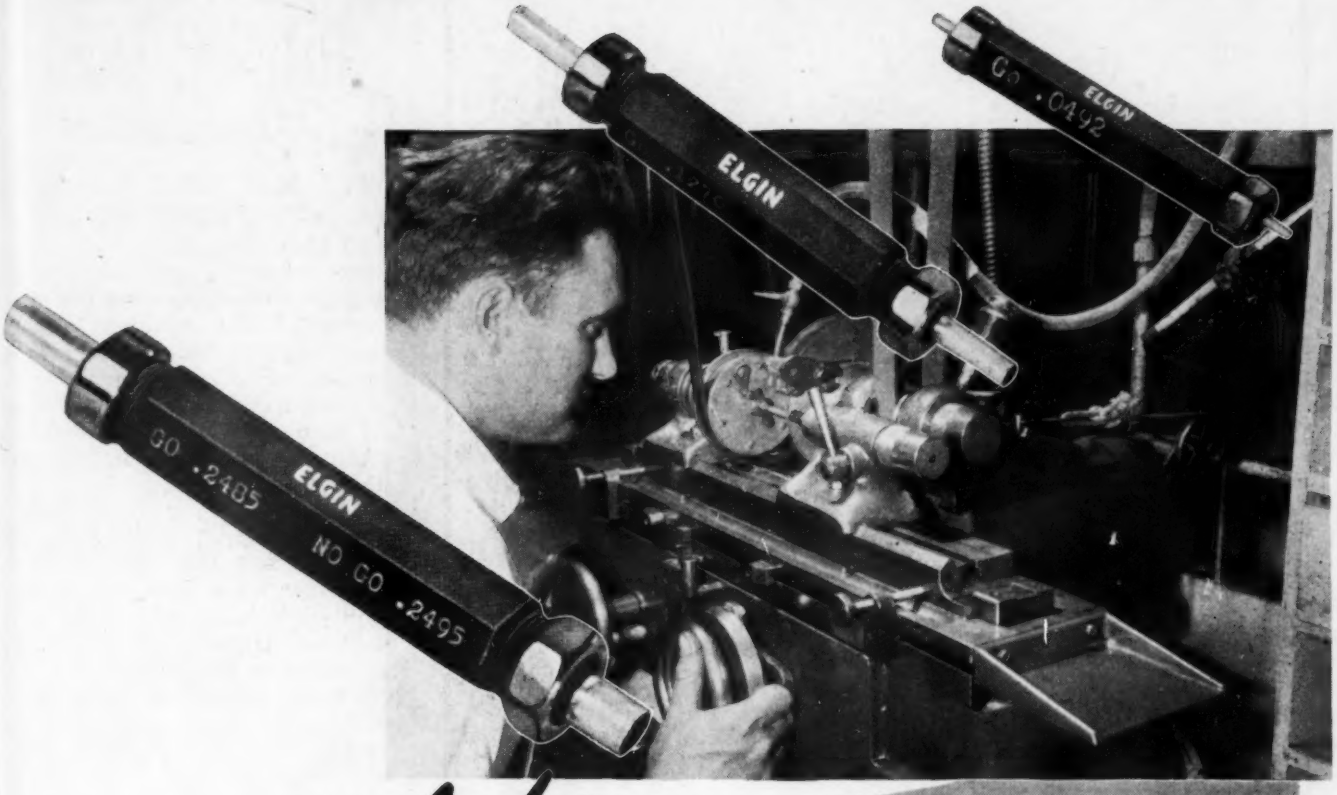
The flat machined flange is said to permit use on most machine tools. A totally inclosed motor of ¼-hp. capacity has bearings which are lubricated for life. The unit is portable and is available in seven different types to fit varying power sources.

Dockson Corp. Line Regulator Reduces Pressure to 1-75 lb.



A line regulator for air and CO_2, Model 45, is produced by the Dockson Corp., 3839 Wabash Ave., Detroit, Mich. The regulator is designed for use where it is necessary to reduce tank pressure to a range of from 1 to 75 lb.

Forged and bar brass are used in the construction of the regulator.



Crystal Lake PRECISION

VITAL IN GRINDING SAPPHIRE

SAPPHIRE as produced by the SAPPHIRE PRODUCTS DIVISION of Elgin National Watch Co. is of a hardness approaching diamond. In making Sapphire Gage Parts, close tolerances must be maintained. It is in the cylindrical grinding of Sapphire Plug Gage members that the precision of Crystal Lake Bench Grinders has been found of value.

These Super Precision Bench Grinders are readily adaptable for this operation due to their small size and conveniently arranged controls.

All motor vibration is removed because of the Crystal Lake Spring Loaded Separate Motor Drive. This design feature also maintains a correct belt tension. Another important design feature is that of the belts which run at a ninety degree angle to wheel slides. This means that the wheel head will not move as in old-style motor mountings.

In your work with metals, if you are finding it a problem to hold your grinding to prescribed tolerances, keep in mind that machines suitable for grinding Sapphire can easily be your answer.

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Many of the country's top-ranking manufacturers look upon our gear engineering facilities as part of their own plant! And rightly so! For over 25 years our job has been the production of precision gears to customers' specifications. Once your specifications are in our files, reorders are filled automatically. As specialists in this field, we have the equipment and experience to do our job well. Let us quote on YOUR requirements now!

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ROUND TABLE *Discussion*

OLD MAN JONAS LOOKS ON AND DOESN'T LIKE IT

Old Man Jonas is one of the old-time bosses whose methods and ways of operating are completely outmoded. He undoubtedly was a good man in his day and earned profits for the company. He was a resourceful and efficient leader of men and probably knew more about the shop and its operations than anyone else.

People will ask "Why was he superseded by Tom Foster?" They will contend Old Man Jonas had forgotten more than his successor will ever know. All this is just talk and is always heard when an old-timer is let out.

In all probability, Tom Foster will meet problems and solve them and will be more receptive to modern methods. This will be particularly true if he has a good technical engineering education and college degree. Planning, methods, scheduling of parts and work, and personnel problems are different today than in Old Man Jonas' day. The latter would be like a fish out of water. And so he is superseded by a younger man, more receptive to new changes in policy desired by management.

Foster's experimental ideas might result in increased costs which will bring a return later on. In the matter of strikes, the younger man will be in a better position to cope with today's labor problems. In Old Man Jonas' day, it was necessary for a boss to work with the men in the shop. This might hold true today in smaller shops, but not in larger plants. If a boss spent time working in the latter plant, production would likely fall off and other, more important matters would slide by unattended.

In the matter of silly college boys setting rates, it's true that the method was abused by shop-wise machinists when it was new, but the bugs have been ironed out today and rate setting is much more satisfactory. Most concerns make on-the-job training compulsory and prospects have to take aptitude tests. In this way, only the superior type of young man is chosen for rate setting. Modern time-study methods have taken most of the guesswork out of setting rates.

Foster's idea about group meetings is sound. Open discussion of shop

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NICHOLSON FILES *FOR EVERY PURPOSE*

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JUST *four reels of Veelos*, the link V-belt, give you a choice of *316 standard sizes* of industrial and fractional endless V-belts. With these four handy reels, a large costly inventory of endless belts is eliminated. Stock records are simplified. There are no spare V-belts to age and deteriorate.

Standard reels of Veelos hold 100 feet . . . require only minimum storage space. Belt replacements for any length drive are always on hand . . . always convenient to locate.

Veelos is quickly and easily installed on any drive. On drives with fixed centers or outboard bearings, it is installed without moving the motor or dismantling the machine . . . in just a few minutes. It provides substantial savings in installation and maintenance costs.

Veelos sales engineers are located in principal cities; 300 distributors throughout the country.

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MANHEIM, PENNSYLVANIA

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THE LINK
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Tested
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Adopted
by American
Industry

Adjustable to any Length
Adaptable to any Drive

problems have been proved advantageous.

Everything points to the fact that executives who worked their way up are being succeeded by men with college degrees but not grease on their hands. No man is so good that he wouldn't be better if he had a college education. With the move for unionizing foremen, management is training bright young men for executive roles. This will spare companies from making men foremen just because they belong to the union.

Some men lacking college educations will always forge ahead to high positions. They will do it by making use of their natural intelligence, hard study, and driving ambition. They will keep abreast of changing policies and be quick to realize the advantages to be gained.

Arthur Silvester
Philadephia, Pa.

•

ARE TRADE SECRETS WORTH KEEPING?

As a young journeyman back in 1907, I had my first experience with a secret-hoarder. While in the process of cutting a thread, an old, cantankerous fellow-worker huddled close to me and asked who had shown me the trick of turning the compound rest around as I had it. "Any crime in a fellow letting me in on a shop kink?" I replied.

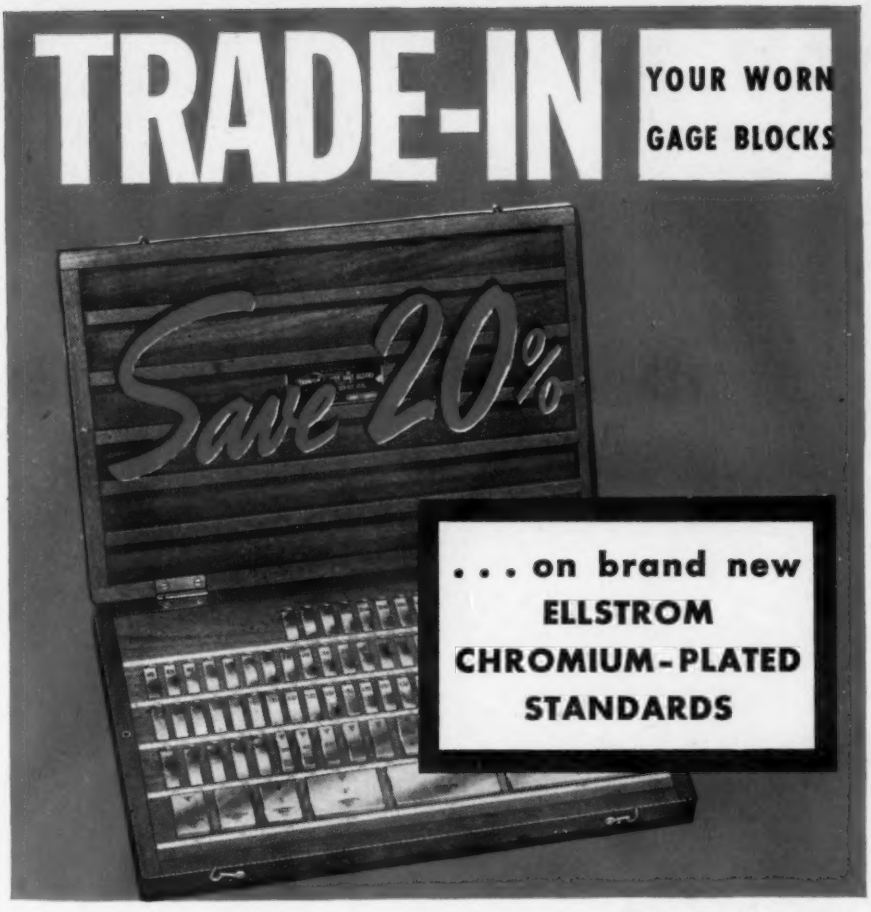
Looking over the top of his spectacles and glancing furtively around to make sure he wasn't being overheard, he confided quietly, "You know, young feller, we should keep those things to ourselves or soon everybody will know as much as we do and then where will we be?"

"At that rate," I replied, "the world wouldn't get very far."

He continued, "If you get a good idea, keep it to yourself." And then with a parting friendly wink, he returned to his bench, where previous to our conversation, I noticed that he had been fussing with a job that in my humble opinion was destined for the scrap pile.

He had made up a solid die of tool steel, measuring 1½ by 4 by 12 in. holes in which six 1¾ in. holes had been bored in line. In hardening, the piece had become hopelessly warped, causing him no end of trouble. My lack of experience on this type of job made me a bit hesitant about my approaching him with an idea I had about it, but I decided to chance it.

"Why don't you make the body of cast iron and insert separate dies into it so the piece won't warp out of shape?" I asked him. Immediately



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(2) On worn rectangular blocks of any other make, you get a 10% trade-in allowance.

(3) Used sets of square type blocks bring you a 10% trade-in allowance regardless of make.

(4) Or, if you have any number of individual blocks in need of replacement, the same discounts will be allowed on the price of replacement.

NOTE: All discounts are based on existing W prices.

Under this liberal exchange plan, you can keep your old blocks until we deliver your new ones—each having the inimitable Ellstrom feature of Chromium plated gaging surfaces to assure you of longer wearing millionths!

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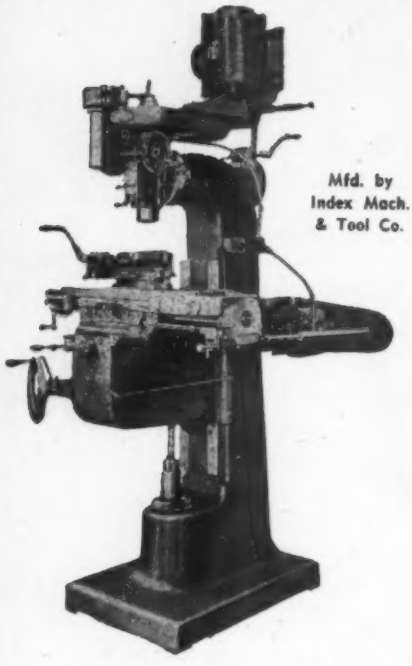
INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



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A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

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JACKSON, MICH.

he saw my point and lost no time in going to the foreman with the suggestion. My idea turned out to be a good one, and the foreman agreed with him and the job was done accordingly. I heard no more from the old man about it, but I often wondered if he didn't pass it off as his idea.

Like this man, there are many others who think it wrong to pass along a good idea or kink to fellow-workers. However, their thoughts are motivated by purely selfish reasoning.

Along the same lines, many companies prohibit visitors lest some of their manufacturing "secrets" leak out for the benefit of competitive firms. In many instances I have been refused admittance toshops for this reason and in direct contrast have been welcomed by others who have given me all the information I saw fit to take. In no case have I noticed the "iron curtain" shop setting the world on fire in the way of growth as compared with the one who threw open its doors to anyone seeking information.

To my way of thinking, an interchange of ideas never hurt anyone and always has contributed something to the general welfare of others.

In effect the Good Book says that you get as much or more out of a thing as you put into it.

J. Homewood
Ontario, California

•

Those who are unwilling to hand out their discoveries and improvements usually find the outside world is not slow to withold from them even to a greater extent than they at the time realize.

Reputations gained by secrecy are not generally well liked and resentment in one way or another is likely to follow.

In other words "Trade Secrets" are looked upon by the average man with more or less suspicion, and he prefers to trade with those with more neighborly methods.

An application for a patent should be made as early as possible for anything that is patentable and is of sufficient value to warrant the expense. Such a step affords protection and offers a way of gaining publicity. Its advertising value should be given careful consideration. Worthwhile ideas often fail to be generally known and prove unprofitable because of limited demand.

A case in point involved a patent on which the 17-year protection clause had expired. During the pro-

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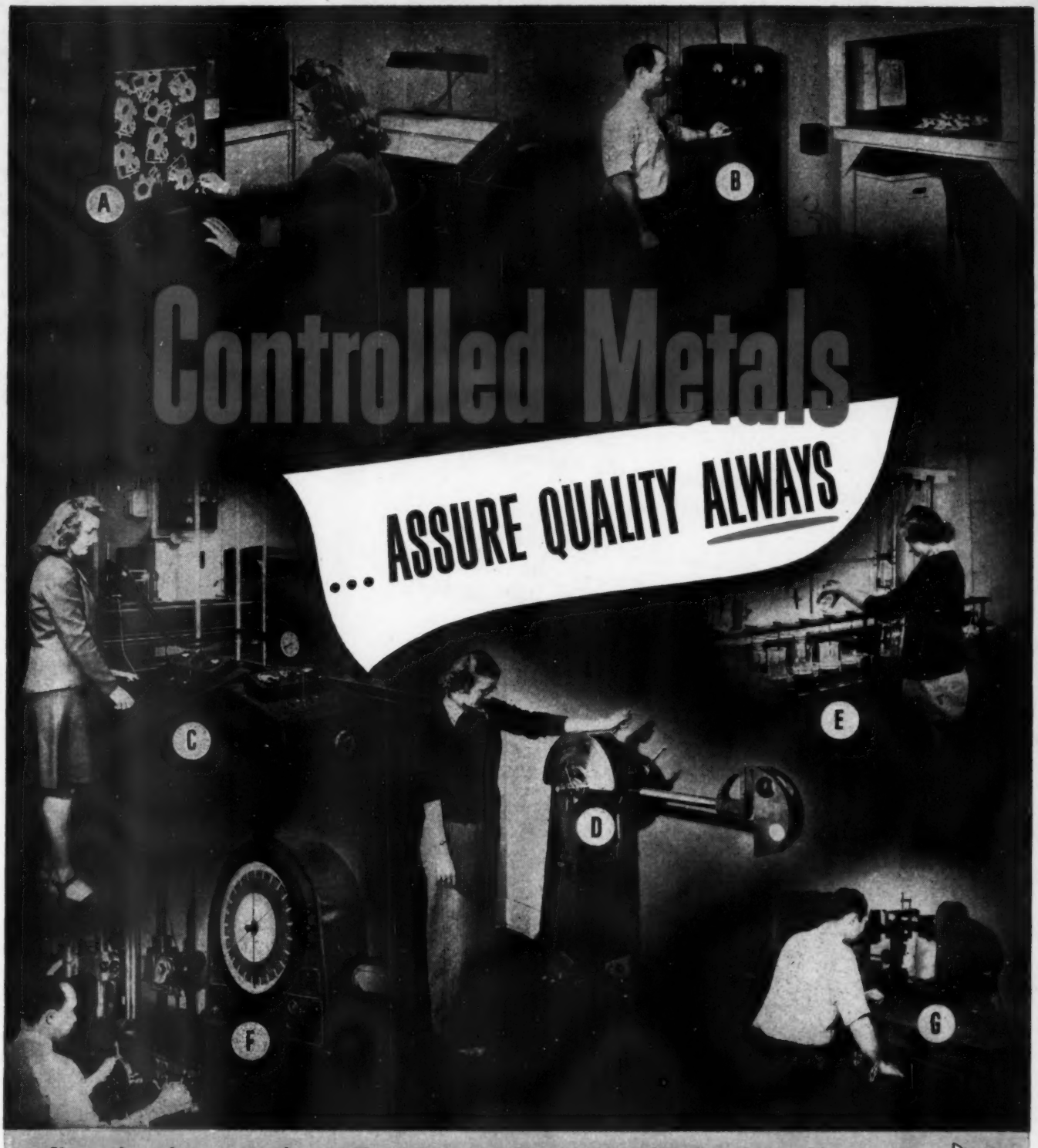

A. X-ray view plate warns of porosity.

B. X-ray machine tests soundness of casting.

C. Spectrograph detects most minute impurities in alloys.

D. Charpy impact machine tests shock resistance of casting material.

E. Chemical analysis assures purity of every alloy used.

F. Tensile testing machine measures the strength of alloys to keep them within all established standards.

G. Metallograph reveals micro structure of metal.

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cut air tool maintenance costs . . . TWO WAYS

1. Knock out destructive air-borne dirt, rust and pipe scale and . . .

2. stop most corrosive oil emulsion and moisture. Deliver clean, power-packed air for smoother air tool and cylinder performance with less wear.

Compact and efficient. No loss of pressure thru the filter. Fine mesh (200 per square inch) double Monel wire screen stops dirt, rust and pipe scale. Design and baffle action eliminates most oil emulsion and moisture. Easy to clean, muck falls to bottom of bowl; open waste cock, blow it out.

Norgren Filters in your air lines keep production up and maintenance costs down. Make air tools operate easier and last longer. Investigate them now. Write for catalog No. 400. C. A. Norgren Co., 222 Santa Fe Drive, Denver 9, Colorado.

Norgren

tective period, the patent kept a business going at some profit, but not up to expectations of the patentee. A rival firm in the same line of business copied the machine on which the patent had expired and put in on the market by advertising more extensively than the patentee had felt it wise to do. However when the owner of the original patent was asked if he was not afraid he would lose a large share of his business, he replied that he believed the fact his rival had copied the patent in every detail would prove to be the best advertising his firm ever had. This statement in the years following proved to be true, as the origin of the machine was soon found out and customers gave preference to the owner of the original patent.

We all like people of a liberal disposition and feel more comfortable among those of that type. There is real satisfaction in sharing and in the long run it usually brings a satisfactory return.

Martin H. Ball
Watervliet, N. Y.

"Quotes"

Technical Men of Tomorrow

E. C. WRIGHT, assistant to the president of National Tube Company, U. S. Steel Corporation subsidiary, cited federal government figures showing thousands of opportunities for technical men in the industrial field. He said:

"Young men who are looking for the shortest path to employment as metallurgical engineers in the steel industry should burn academic oil, especially on the fundamental sciences.

"Graduates of standard engineering colleges generally prove readily adaptable to the practical phases of steel metallurgy. But engineer graduates sometimes tend to bring with them more generalities on applied industrial engineering than needed in the steel industry.

"Engineering students seem more suited to actual work in steel plants and in general are better able to grasp a knowledge of operations observed. Moreover, graduates of engineering schools have a superior training in physics, mathematics and engineering, but even then it has been a general and continued observation that most students em-

Which "Surplus" TOCCO Machine fits *your* induction heating job?

Let us help you decide.

We maintain complete records of every TOCCO machine ever sold. We can tell you the date it was shipped from our factory . . . the job for which it was originally designed . . . and complete specifications of the unit as it was shipped.

If you intend to buy a Government Surplus induction heating unit, be sure to consult us first because, whether you buy a new TOCCO machine from us or a used "Surplus" unit from the War Assets Administration, we want to make sure that it is the right TOCCO unit for your particular requirements.

Contact us so we can tell you how adaptable any "Surplus" machine is to your particular job. We are authorized dealers for Government Surplus TOCCO Equipment and can facilitate your purchase.

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The Lyon

INTERNAL GROOVING TOOL

Its versatility saves costly preparation time—provides precision grooving of single or multiple grooves at a production rate—plus economy of set-up time—and low initial cost. The LYON has been designed for making internal grooves to tolerances of .001" using any drill press, turret lathe, radial drill or automatic equipment.

By changing only bushings and cutters within the tool model range, you have at your command a wide variety of bore sizes and shapes. A simple adjustment regulates location and depth of groove. Work cannot be scratched or marred because the head of the tool does not turn when the cutter operates.

Our Engineering Department will welcome the opportunity of discussing any grooving problem without obligation.

LYON MACHINE CO., WORCESTER 3, MASS.

ployed had inadequate training in such fundamental sciences as physics, physical chemistry, thermodynamics, and mathematics higher than simple calculus, all of which are essential to good work.

"By the present training schedule, at least five years of practical experience following four years in an engineering school is desirable in developing a good metallurgical engineer.

"The training of technical graduates has fairly well crystallized into a routine, and satisfactory results are being obtained in developing such men. It has been found that the finished metallurgical engineer needs thorough understanding of routine analytical chemistry and physical testing procedure, a good knowledge of statistics, ability to handle men, a thorough knowledge of the processes and operations in the plant in which he works and finally, ability to analyze difficulties and conduct research work."

•

Human Engineering

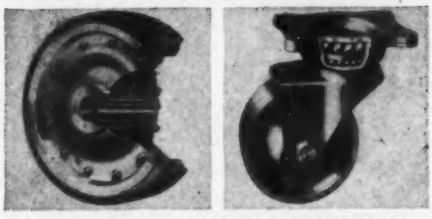
SPEAKING ON "The Future of Industrial Training," Earl G. Planty, Training Director of Johnson and Johnson, prophesied great progress in the next 15 years if industry turns to its human problems with the same energy it now devotes to its mechanical processes. He said:

"Industry is full of men who can tell why a machine doesn't work, but not why a man doesn't work. Management, from top executive to plant supervisors, must be trained to see men as material that will grow, that can be molded and developed, that have more potential for greater production than does the machine. Psychologists, sociologists and other in the human-engineering field must be brought into the industrial system to add the full extent of human resources to that of the machine. Men who have spent a lifetime dealing with problems of cost or engineering cannot be expected to turn successfully to the problems of personnel.

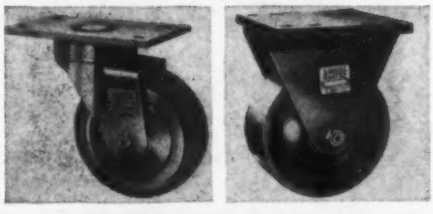
"Training must stop 'putting out fires' and concentrate on prevention rather than correction of production problems involving employees. It must concentrate on broad development of people to meet whatever situations arise.

"If future training is given standing, prestige and financial support appropriate to its value to industry, it can add to the present scientific and technological knowledges those

An EXTRA MEASURE *of* QUALITY



DARNELL CASTERS



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Schrader Air Pressure Regulators will save you money! They'll let you cut the air demands on your compressor from high to low. Air regulated lines mean longer compressor life and reduced maintenance cost, and you'll get better work.

Write for complete information and literature.

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AIR PRESSURE REGULATOR

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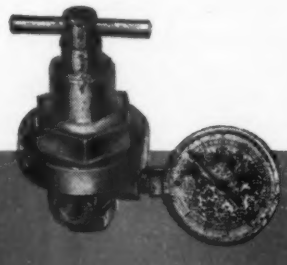

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CONTROL THE AIR

A. SCHRADER'S SON, Division of Scovill Manufacturing Company, Inc., BROOKLYN 17, N. Y.

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Laminum shims are cut to your specifications. For maintenance work, however, shim materials are sold through industrial distributors.

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THE SOLID SHIM THAT peels FOR ADJUSTMENT

abilities in leadership of men which have greater possibilities in the promotion of greater production than has any other sphere at present."

•

Better Understanding

AFTER SIGNING a new union contract, William L. Batt, President of SKF Industries, Inc., and Clinton S. Golden, International Vice President of the United Steel Workers of America were principal speakers at a joint meeting of foremen and union stewards. Excerpts from the remarks of both men follow:

Mr. Batt: "Good relationship between union and management must be provided by the company foremen and the union stewards in the plant. The foremen know the needs of the company and the stewards know the desires of the union. Mr. Golden and I provide the atmosphere, but you must lay the solid foundation on which sound relations can be built. If when there is disagreement, the facts of each issue are made clear to each other, a fair solution usually will come about . . ."

Mr. Golden: "Neither the stockholders, the management, or the workers alone and by themselves can operate the works. It is only when all three groups join together their resources — financial, managerial, technical and production skills and know-how — that raw and semi-finished materials are transformed into useful products that fill human needs and requirement. It is through the continuing efficient production and sale of these products at fair prices that all of us can be assured of regular employment at good wages and salaries."

NEW BOOKS

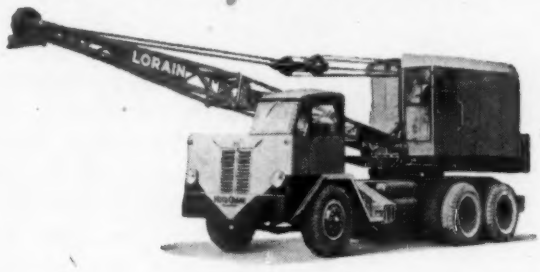
THE PERSONNEL PROGRAM OF JACK AND HEINTZ—*By Roswell Ward. Published by Harper & Brothers, New York City. 146 pages. Price $2.*

Popular discussion of the much publicized personnel policy of Jack & Heintz while the war was on was confusing and misleading. Newspaper and magazine sensationalism had enveloped the basic principles behind the program in a heavy fog.

This latest analysis, made by a personnel authority with no axe to grind, should be helpful to both labor and management in their search for common ground. The author takes up three elements of study; brain power, machine power

How ORANGE ROLLER BUSHINGS are meeting many design problems

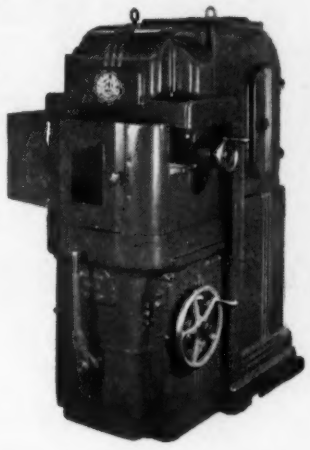
Heavy Loads—



● Thew-Lorain Moto-Cranes revolve on six Orange Roller Bushings in the front turntable. They carry the weight of cab and booms, plus lifting-loads up to 20 tons. Whether your problem is high weight load or torque load, Orange Roller Bushings will carry it—yet hold to limited space requirements.

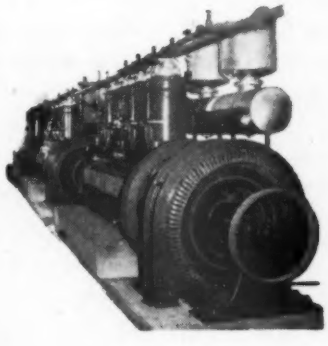
Precision Running—

● Orange Roller Bushings are used in the cross feed shaft and motor shaft of the vital Cone Drive in Michigan "806" Rotary Gear Finishers, which run so smoothly, they are almost completely noiseless. An excellent example of the even, quiet running resulting from closer internal clearances of Orange Roller Bushings.

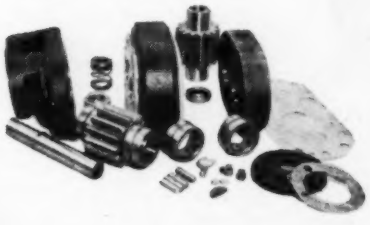


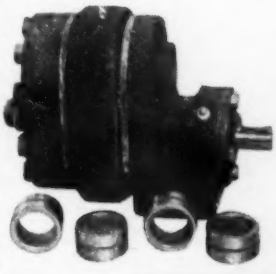
Severe Shock Loads—

● This 1150 h.p. Venn-Severin Diesel Engine carries continuous loads of 700 k.w. 24 hours a day, 6 days a week. All piston pins run on Orange Roller Bushings and are subjected to heat and repeated shock loads caused by combustion. Venn-Severin Machine Co. has used Orange Roller Bushings for a number of years with highly satisfactory results.



Compact Assemblies—





● This Gear Type Hydraulic Pump, made by Commercial Shearing and Stamping Co., shows how the smooth-running protection of Orange Roller Bushings is obtained in a compactly designed product, where space is limited and operating conditions are severe.

WHAT IS YOUR BEARING PROBLEM? *Orange Roller Bushings are available in a wide range of sizes, to meet practically all requirements. Consult with our engineers.*

ORANGE ROLLER BEARING CO., INC.
554 Main Street, Orange, N. J.

Mail Coupon for Engineering Data

Orange Roller Bearing Co., Inc., AM
Orange, N. J.
Please send me your Roller Bushing Data Book

Name..... Title.....

Company.....

Address.....

City..... State.....

GRAPHITE GUS SAYS:

GRAPHITE NEVER RUNS A FEVER...

...that's why DIXON'S LATHE CENTER LUBRICANT STOPS

- WEAR
- SCORCHING
- BURNING
- BREAKDOWN

It will pay you to keep a tube by every lathe in the shop. And to use it for other hot-spot lube problems where extreme film strength is required.

DIXON'S GRAPH-AIR GUN TYPE 4

Handily blows its contents of dry powdered Microfyne Graphite into locks and all close-fitting mechanisms. Provides long-lasting lubrication that is exceptionally resistant to extremes of temperature. In shop, office and home it's the most useful lubricator ever. Read Data Sheet #8. Buy a gun at your supply house. 30¢

SEND TODAY FOR THE DIXON DATA SHEET DIRECTORY. IT LISTS 20 FAMOUS GRAPHITE PRODUCTS

JOSEPH DIXON CRUCIBLE COMPANY

Div. 4C11 — Jersey City 3, N. J.

and manpower. He points out how management efficiently exploited the first two but ran up against a blank wall in the third. Bill Jack, it pointed out, took the first two for granted and devoted himself to progressive experiments in the field of human relations. It is not too important that the experiments were carried out under ideal conditions; what is important is that the experiments have been undertaken and made available for serious study.

Mr. Ward carefully follows Jack's 30 points in getting the most out of manpower. The important fact, he states, is not that these points were invented before Jack utilized them but that he harnessed them and put them all to work at the same time.

Throughout this document on personnel administration the accent is on the human relations and the tangible results of cooperation achieved by far-sighted management.

In concluding his book Mr. Ward says, "Reconversion offers an opportunity to re-orient manpower methods as well as the brain-power and machine-power methods mentioned. One thing is certain — an organization which has the resourcefulness and the vision to develop new and improved personnel relationships is sure to be able better to meet any of the other tests of technical or financial adaptability which may occur in the future."

•

JOB PLACEMENT OF THE PHYSICALLY HANDICAPPED—*By Clark D. Bridges. Published by the McGraw-Hill Book Company, 330 West 42nd Street, New York 18, N. Y. 329 pages. Price $3.50.*

This book is intended for the employer, supervisor, foremen, personnel manager, safety engineer, and others who hire, select, place and supervise manpower. It represents a constructive guide in the rehabilitation and employment of disabled or handicapped workers and opens the way for use of a vast reservoir of valuable manpower.

Information necessary for the appraisal of a prospective employee, who is disabled, is presented. Essential features of physical abilities and work limitations, safety engineering, and health conservation have been assembled so they can be considered in their individual and collective relationships to efficient employment.

Many of the subjects treated in the definitions of the terms used in job appraisal have been covered in condensed form. New methods of physical examination reporting, of

Patented HY-CO CENTER-DRILLS WILL SAVE FOR YOU, TOO!

Unbelievable savings are reported by every shop using the new, Patented HY-CO Center Drills. Send for proof in booklet—"A Winner 4 to 1." See how "tip clearance" helps prevent center drill breakage; why "HY-CO Center Drills" have no fatigue point; how LINE CONTACT with the Center abolishes out-of-round work. Send card with name and company for booklet to Dept. AB.

NO MORE Push-Pull-Lift-Lug

Modern materials-handling methods are rapidly cutting down the physical effort once necessary in manufacturing activity. Cranes and conveyor systems; lift trucks and hoists . . . these and other sweat-savers are reducing costs while production rises.

If you'd like to know more—copies of "Modern Materials-Handling Methods", *American Machinist's* Special Report for June 20th are still available in limited quantities. We'll be happy to fill your order. 15¢ a copy—13¢ in quantities of 50 or more.

AMERICAN MACHINIST
330 West 42nd Street
New York 18, N. Y.

OUTSTANDING PERFORMANCE IN SERVICE!

THE MACHINE—*Lewis Wire Straightening and Cutting Machine*

THE CASTINGS—MEEHANITE

Close-up of MEEHANITE revolving arbor and straightening blocks

Traveling cut-off Head cast in MEEHANITE

The latest development in wire straightening and cutting equipment is being manufactured by The Lewis Machine Company, Cleveland, Ohio. A major application of this equipment is the production of welding rods perfectly straight to exact lengths at high speed.

The straightening arbor illustrated is a Meehanite Casting in which slots are cored to receive the Meehanite straightening blocks. In service wire is drawn through the revolving arbor which straightens the wire by pressure applied by the straightening blocks.

After considerable experimentation no other material provided the economic service life and produced wire free from scratches as well as Type GA Meehanite straightening blocks, hardened by quenching from 1600°F. and drawing at 350°F.

Other Meehanite Castings in the machine include a flywheel with integral bevel gear, traveling cut-off head, various arms and levers.

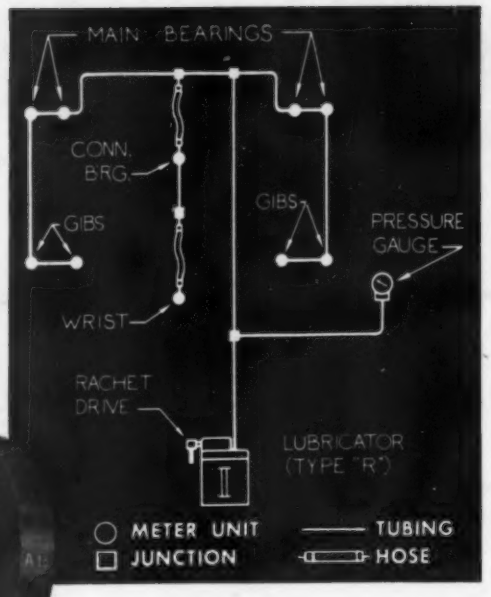
All parts described require high strength, wear resistance, dense, uniform castings—high quality.

Write for our Bulletin No. 20 "Meehanite—the Metal for Wear Resisting Castings"

MEEHANITE *Means* **BETTER CASTINGS**

PERSHING SQUARE BUILDING, NEW ROCHELLE, N. Y.

CASE HISTORY
No. 285
from the
BIJUR FILES



"BLISS" No. 30 *Inclinable Press*

SPECIFICATIONS

LUBRICATOR:
Cyclic type
Drive from press slide
Reservoir capacity—3 pints
Discharge volume—1 ½ cubic centimeters
Pressure—45 lbs. per sq. in.

DISTRIBUTION:
Number of meter-units—10
Tubing—5/32" O.D. x .020 wall steel

Standard equipment on a wide range of machines in the metal-working industries is a built-in Bijur system of central lubrication. This system is *automatic*, starting and stopping with the machine. At infrequent intervals, the operator fills the lubricator . . . the rest of the time he can devote full attention to production while the system meters to each bearing the correct amount of oil *automatically*. No shut-downs for lubrication . . . no "forgotten" bearings . . . no "feast and famine" periods. Production is up — maintenance costs are down.

BIJUR LUBRICATING CORPORATION
Long Island 1 • New York

BIJUR
AUTOMATIC *Metered* LUBRICATION

FOR FURTHER DETAILS WRITE FOR BULLETINS 3B AND 4A

job analysis specially designed for employee placement, and of matching workers to jobs are recommended in the text. The study is devoted primarily to the physical abilities of workers and so the subjects of worker skill, aptitude, training and education are scarcely mentioned.

The book should contribute to pointing the way toward placing physically handicapped workers in jobs.

•

WELDING ALUMINUM AND ALUMINUM ALLOYS — *Reynolds Metals Co., Louisville 1, Ky. 88 pages. Price $1.*

This comprehensive discussion of the latest practices of welding aluminum and its alloys covers gas welding, arc welding, resistance welding, brazing, and soldering. A brief discussion of the weldability of various alloys opens the book.

The arc-welding section includes chapters on metal-arc, carbon-arc, atomic-hydrogen, inert-gas-shielded processes. The section on resistance welding includes four methods of spot welding, seam welding, and flash welding.

The various methods are described in a straightforward manner with much practical information included. The book is well illustrated and has a convenient index.

•

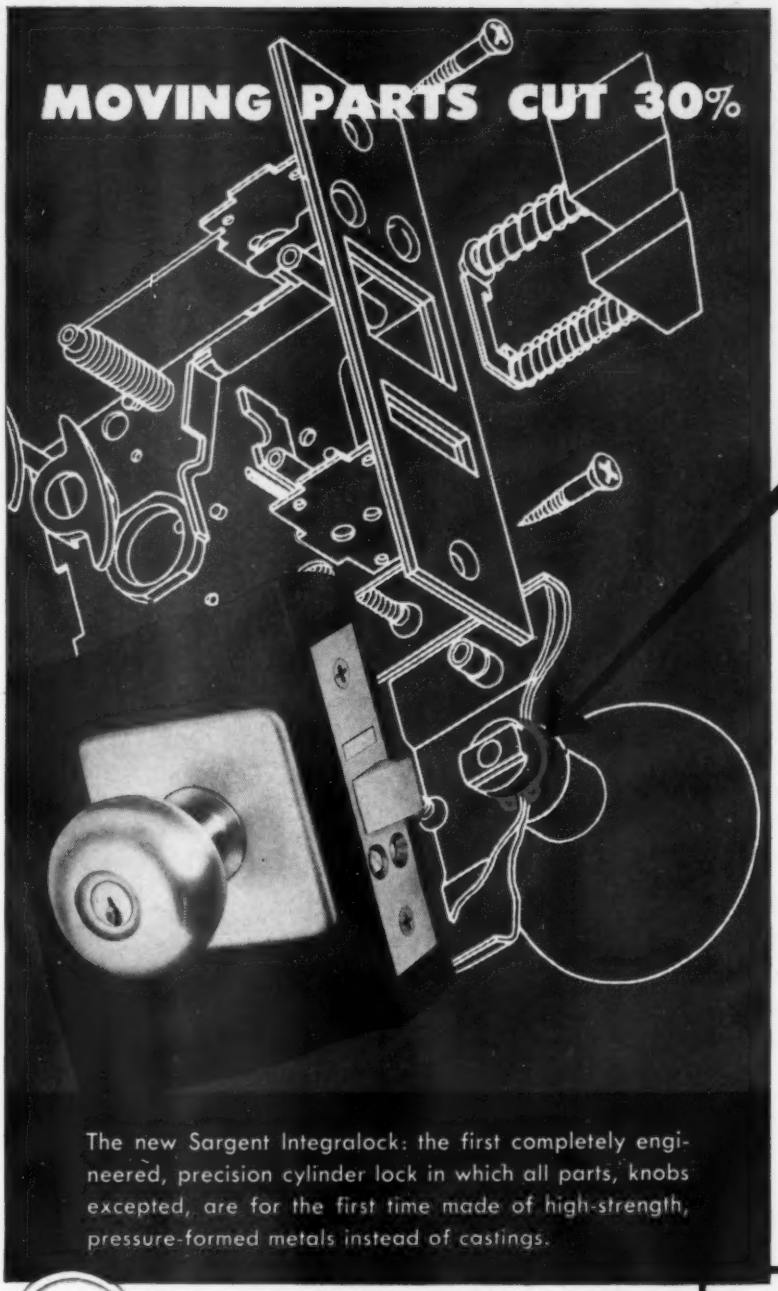
FINANCING SMALL BUSINESS — *Published by the National Association of Manufacturers, 14 West 49th Street, New York 20, N. Y. 32 Pages. Free.*

This booklet is one of the most comprehensive studies of the financial and economic problems of small business (firms employing less than 500 workers). Since small business represents 93% of all the business concerns in the nation, accounts for 45% of total workers, and does 34% of the business volume, the importance of the solution of the financing problems of this large segment of the economy is brought out. The development of various forms of governmental and private aid is traced, along with the means of securing such help. In addition, certain key recommendations are made or suggested by the booklet's conclusions.

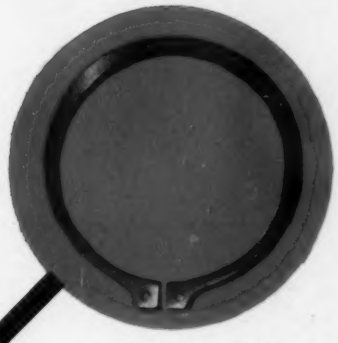
The work should be helpful to already existing small businesses, and to individuals planning to start their own businesses.

It might be noted that 71% of the NAM's membership comprises small business firms, which accounts for the organization's interest in the subject.

TRUARC helps Sargent produce superior lock at lower cost!



The new Sargent Integralock: the first completely engineered, precision cylinder lock in which all parts, knobs excepted, are for the first time made of high-strength, pressure-formed metals instead of castings.



U. S. PAT. RE. 18,144

"TRUARC HELPED MAKE THIS LOCK POSSIBLE" says Sargent & Company, New Haven, Conn., leading lock manufacturers for 74 years.

IN DESIGN: "Waldes Truarc Retaining Rings permit closer tolerances; result in more compact design; provide full circumferential bearing at vital points; help to make possible a 30% reduction in moving parts."

IN PRODUCTION: "Truarc reduces machining operations, cuts assembly time, helps eliminate the grub screw hitherto universally deemed essential."

IN SERVICE: "Truarc maintains accurate, unvarying relationship of parts, simplifies disassembly and reassembly, reduces possibility of damage in making repairs."

IN COSTS: "The many advantages provided by Truarc have contributed to the great economies that enable us to produce this finer-lock at a new low cost for a quality product."

Whatever your product, whether old and basic, or a comparative newcomer, there's a Waldes Truarc Retaining Ring that will make it simpler, more economical to make and repair. For Truarc, with its never-failing grip and patented design assuring constant circularity, gives you a new approach, a superior solution to fastening problems. Send us your drawings; Truarc engineers will be glad to show how Truarc can help you.

Send for booklet containing interesting engineering data.

WALDES

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Waldes Kohinoor, Inc., **KEY 12H**
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Please send Booklet on Truarc Retaining Rings to

Name & Title_____

Firm_____

Address_____

City_____ Zone____ State_____

VISIT TRUARC BOOTH AT NATIONAL METAL CONGRESS, ATLANTIC CITY, NOVEMBER 18-22

WHEN MACHINING COSTS

You need this Improved

MORE THAN MATERIAL...

MACHINABILITY

The sealing plug for aircraft hydraulic mechanisms at the left is a good example of what we're talking about. A lot of machining goes into its fabrication on hand screw machines and drill presses—machining which costs considerably more than the steel from which it is made.

That's why UNION SUPERCUT (A.I.S.I. B-1113) is used for this and countless other steel parts.

UNION SUPERCUT is an *improved* free-machining Bessemer Steel—improved not once but many times. It is the steel which, because of its high machinability, made necessary the redesign of automatic screw machines. It is the steel which for uniform machinability has led the field ever since it first was developed.

In the production of UNION SUPERCUT. UNION FREE CUT (B-1112) or any of the open-hearth or electric furnace grades produced by Union Drawn Steel Division, *MACHINABILITY* always gets top consideration.

As a result, speeds and feeds have been repeatedly increased, tool-wearing abrasives in the steel reduced and the smooth, bright machined surface improved. Because of the increase in machinability effected by furnace treatment, capacities for annealing, normalizing, spheroidizing, stress relieving and other heat treating have been expanded.

Whether you produce a complicated part like that at the left or one more simple in design, you need the improved machinability of Union Cold Drawn Steels to help you make better steel parts faster and at lower cost.

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic

UNION COLD DRAWN STEELS

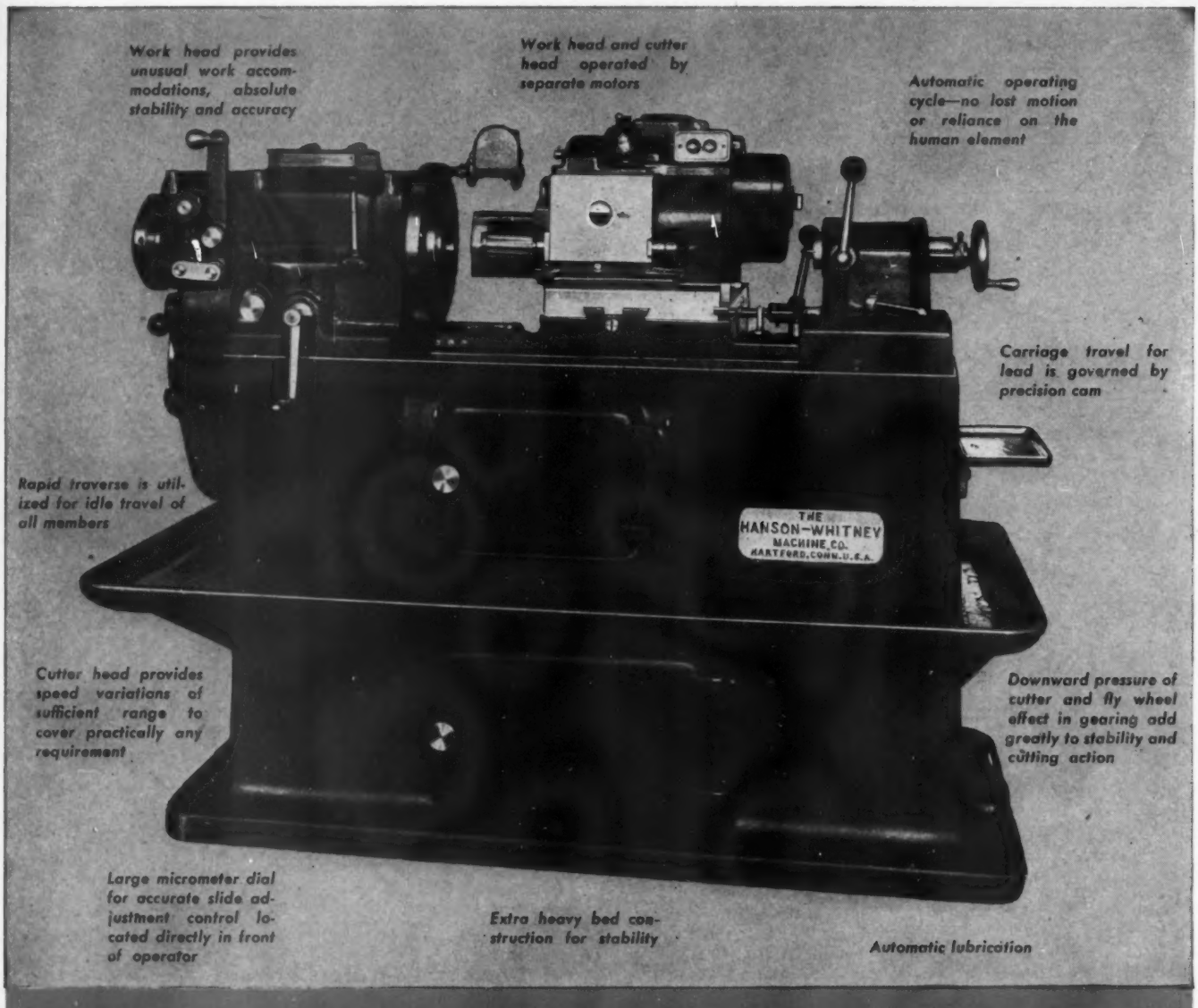
Reg. U. S. Pat. Off.

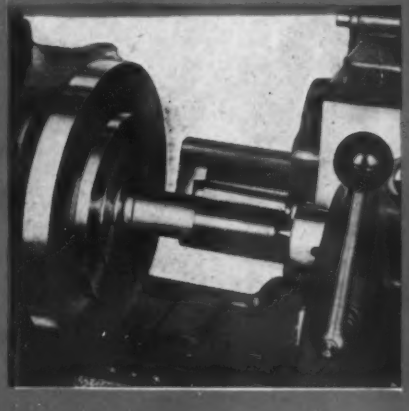
Free-Machining Bessemer, Open-Hearth and Electric Furnace Steels

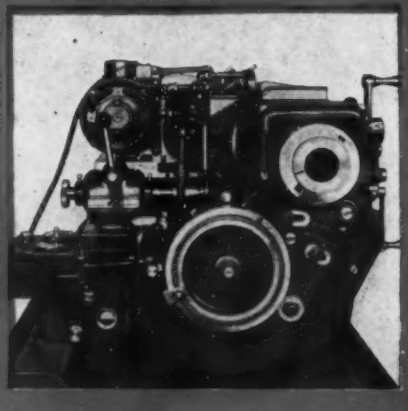
Union Cold Drawn Special Sections

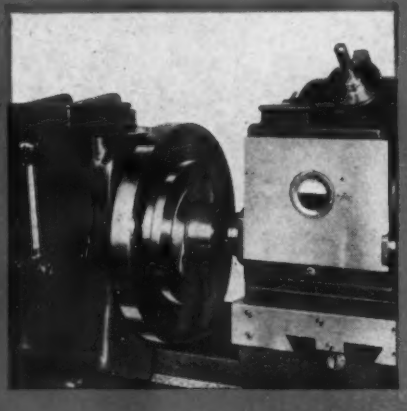
Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Shafting)

YEARS OF SEVERE SERVICE


Work head provides unusual work accommodations, absolute stability and accuracy
Work head and cutter head operated by separate motors
Automatic operating cycle—no lost motion or reliance on the human element
Carriage travel for lead is governed by precision cam
Rapid traverse is utilized for idle travel of all members
THE HANSON-WHITNEY MACHINE CO. HARTFORD, CONN. U.S.A.
Cutter head provides speed variations of sufficient range to cover practically any requirement
Downward pressure of cutter and fly wheel effect in gearing add greatly to stability and cutting action
Large micrometer dial for accurate slide adjustment control located directly in front of operator
Extra heavy bed construction for stability
Automatic lubrication







HAVE TEST-PROVED THESE MACHINES

FOR FAST ACCURATE THREAD CUTTING

Consider these advantages:

1. Suited for external or internal threads, right or left hand. 2. Taper threads are produced as accurately as straight threads. 3. Threads irrespective of length are finished in one revolution of work (within the capacity of the machine). 4. Work held on centers or directly in spindle by quick acting collet mechanism (manual or air). 5. Set-up requirements are very simple, can be accomplished in a few minutes.

Hanson-Whitney Thread Milling Machines have proved their worth year after year . . . by producing perfect threads in quantity . . . at less cost.

Think of the big savings you can realize when you have *one* machine that will cut external or internal threads, right or left-handed, straight or tapered . . . automatically.

The simplicity of design in Hanson-Whitney Thread Millers means less set-up time . . . lower equipment costs . . . smaller floor space and fewer man hours. Such savings may well make the difference between profit and loss in these days of rising production costs.

Hanson-Whitney engineers can help you to gain a better competitive position by improving your thread milling production and cutting your costs. For further information write: **Hanson-Whitney Machine Company, Hartford, Connecticut.**

Hand it to **Hanson-Whitney**

MACHINE COMPANY

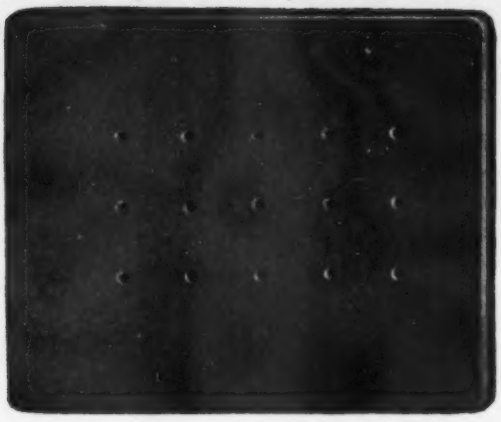
HARTFORD • CONNECTICUT

15 holes in 15 minutes

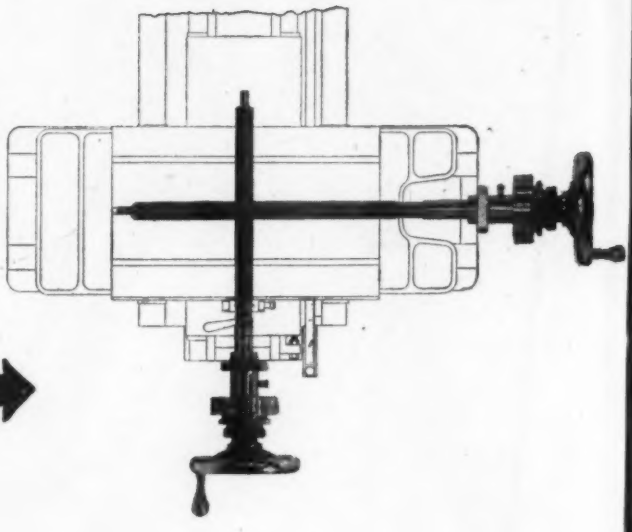
Spotted, Drilled and Reamed to ±.0002″

by the

Coordinate Hole Location Method*



...because
Micrometer Lead Screws
Accurate to
.0002″ in 16 inches



...Speed Table Settings
on the
MOORE JIG BORER

*One boring cut to increase accuracy to ±.0001″ would require only five minutes additional time for all fifteen holes. Write for descriptive literature.

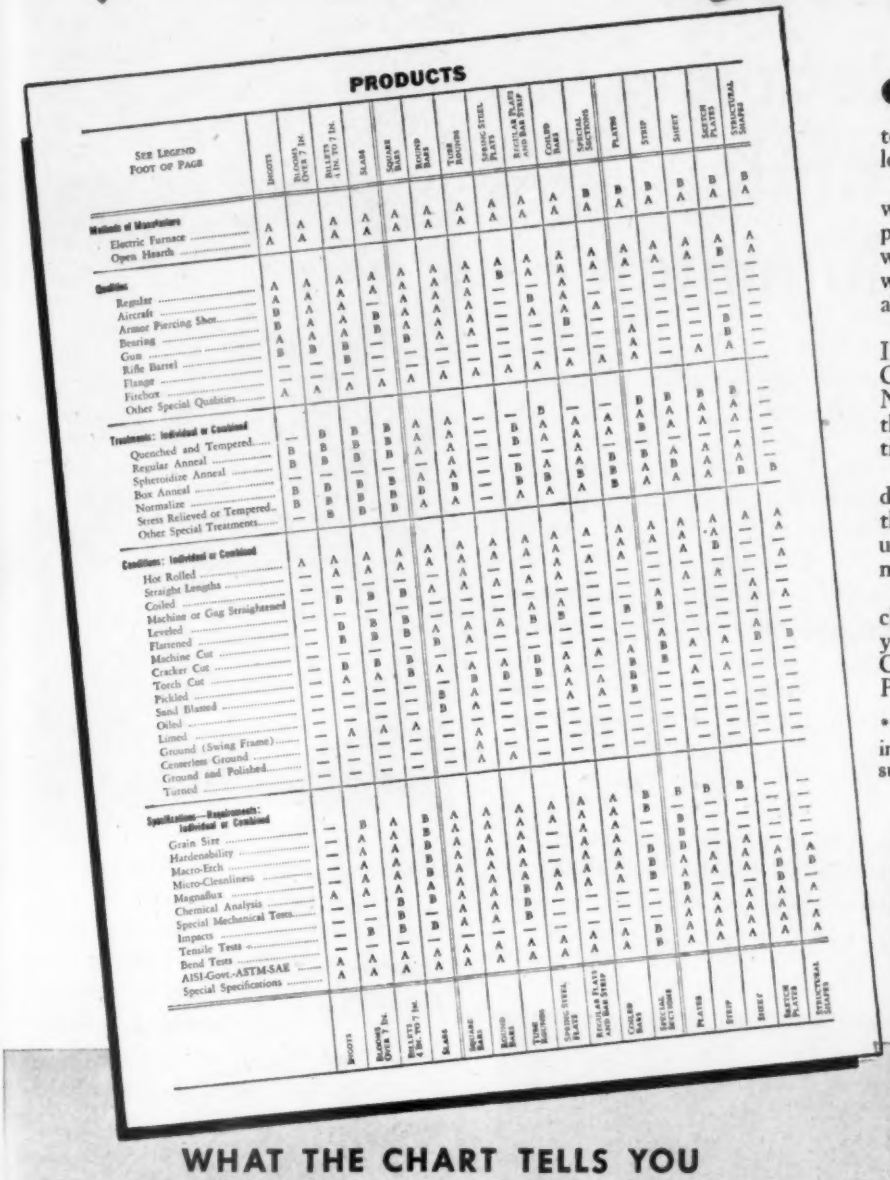
MOORE TOOLS

MOORE JIG BORER

MOORE SPECIAL TOOL CO., INC., **Union Avenue, Bridgeport 7, Conn.**

WHATEVER YOU NEED IN ALLOY STEEL

you'll find on this Carilloy chart



● WHEN you want to know in a hurry where you can get a form of alloy steel to meet your special requirements, you need look no further than this Carilloy chart.

Prepared by alloy steel experts . . . men who are intimately informed on all our vast production facilities and who know exactly what we can or cannot make . . . this chart will save time and trouble for every buyer of alloy steel.

It shows you how completely Carnegie-Illinois is equipped—both in Pittsburgh and Chicago—to meet all* of your requirements. No other producer of alloy steels can match this wide range of facilities, products, qualities, conditions, and treatments.

By relying on this source, you can expedite deliveries . . . save shopping time . . . ensure the same high quality in every part you manufacture. Result: superior finished products manufactured at the lowest possible cost.

If you would like to have a copy of this chart for your files, we shall be glad to send you one. Write to Carnegie-Illinois Steel Corporation, Carnegie Building, Pittsburgh, Pennsylvania.

*Except for cold drawn bars and any form of tubing . . . which are available from other U·S·S subsidiaries.

WHAT THE CHART TELLS YOU

Where "A" appears in the block it means that Carnegie-Illinois has equipment and facilities for handling each product listed in heading to the methods of manufacture, qualities, treatments, conditions, or specifications listed in left-hand column and that these are common requirements for alloy steels in the various products shown.

Where "B" appears in the block it means virtually the same as outlined in "A" except that the requirements are not common to alloy products but equipment and facilities are available if needed by any consumer.

Where the block is filled in with a dash, it means that the conditions in the left-hand column seldom if ever apply to the products in the heading and as a result, equipment has not been made available for production. In many cases, however, by special arrangement even these methods of manufacture, qualities, treatments, conditions or specifications can be supplied on some of the products in the heading.

U·S·S
Carilloy Steels

ALLOY STEELS FOR THE SPECIAL JOBS OF INDUSTRY

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
Tennessee Coal, Iron & Railroad Company, Birmingham, *Southern Distributors*
United States Steel Export Company, New York

USS STEEL — UNITED STATES STEEL

UNITED STATES STEEL

PERFECT RESULTS in Drilling, Reaming, Boring and Milling of Aluminum

"Recently we were called in to the plant of a large manufacturer in Ohio to look over a Cutting Oil job on aluminum work.

"The material to be formed was an aluminum die cast block. This block is a part of the lock mechanism on bank vaults and consequently must be about perfect in the machining.

Lubrication Engineer's Report

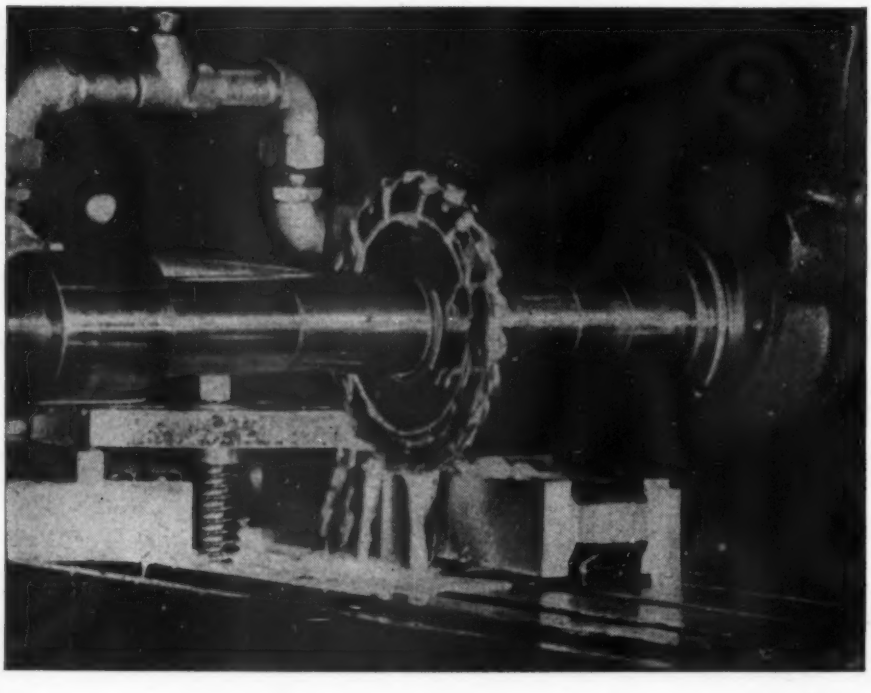
"The work to be done on this block included drilling, reaming, boring and milling.

"After studying the conditions, we recommended Cities Service Chillo Oil No. 22 and received an order for a drum of this material for trial use.

"We were called back about two weeks later and the plant superintendent came up with one of the blocks which he had machined with the oil recommended. He was completely satisfied with the results. The block had not only a smooth machine finish, but a completely burnished finish. It was a beautiful piece of work.

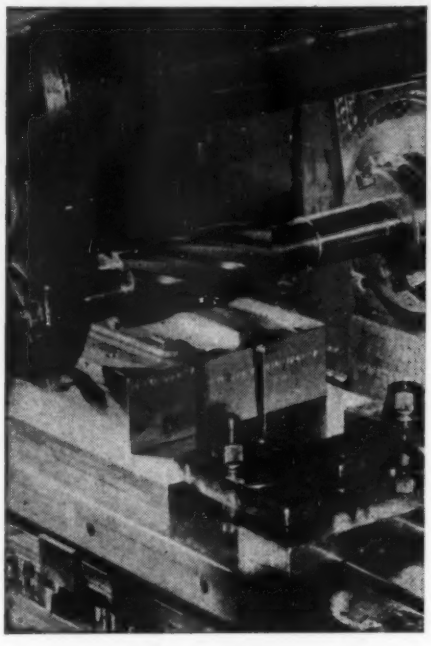
Smooth, Burnished Finish

"As a result this plant has standardized on Chillo Oil No. 22 for all aluminum machining and we are currently receiving orders for the oil as required.



"Our unusually successful experience with Chillo Oil No. 22 leads us to recommend it for practically all aluminum machine work."

Through continual contact with the many and varied lubrication problems encountered by industry over the years, Cities Service Lubrication Engineers have accumulated considerable information on ways and means for reducing costs and improving the performance of lubricants. Why not find out for yourself how they can help *you!* Contact your nearest Cities Service branch office or write to Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y. (In the South, Arkansas Fuel Oil Company.)



Expert Counsel Available

FOR EVERY LUBRICATION PROBLEM

CALL Cities Service FIRST!

HOW TO *Cut Costs and "Corners"* ON YOUR BLANKING DIES

You can save steel and time in the making of dies for blanking, trimming, beading, or any application involving the cutting of sheet metals to regular or irregular shapes, by assembling them from FCC Composite Steel Die Sections.

These prefabricated die parts consist of fine tool steel cutting edges, in a selection of grades, electrically welded by a special process to non-hardenable mild steel bases. Thus, screw and dowel holes may be easily drilled after heat treating, and there are numerous other advantages that will be immediately obvious to the die maker.

Thousands of die shapes may be made up from combinations of thirty-five standard sections. Specially shaped sections are manufactured to customers' specifications in five to ten days.

● Make *your* dies this money-saving way—full data on request.

Write for New Booklet:
COMPOSITE DIE SECTIONS

Contains complete data on 35 Standard Die Sections, from combinations of which thousands of die shapes can be made—also full information on Special Die Sections, and how to order.

● *Get your copy . . . write for it today.*

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Forging and Casting Division
Detroit 20, Michigan

MOLYBDENUM IN THE FOUNDRY....

ROLLS are among many cast and wrought iron and steel products that have been improved by Molybdenum. Very small additions, rightly introduced, yield surprising results. In the case of mill rolls, Molybdenum makes the difference between a reasonably good roll and one that is stronger and and tougher, and especially better adapted for operating at high temperatures.

This is only one of many uses that Molybdenum serves to the betterment of foundry products. Its most valued effects are to strengthen and toughen—especially to improve high-temperature strength and uniformity of strength in both light and heavy sections. Foundry practice need not be altered at all when Molybdenum is added to any iron or steel composition.

The Molybdenum Corporation has a special pamphlet on the foundry uses of Molybdenum. As a supplier of Molybdenum, Tungsten, and other alloying materials, the Corporation welcomes the inquiries of any user.

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TAKE the heat treating, cleaning and straightening 'stops' out of the smooth flow of your parts production with Wyckoff Heat Treated Cold Finished Steel.

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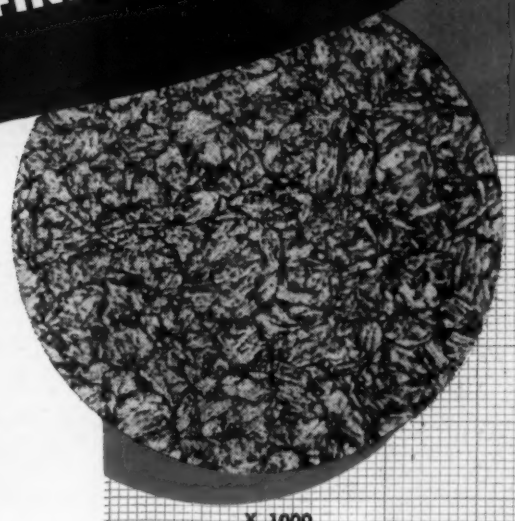

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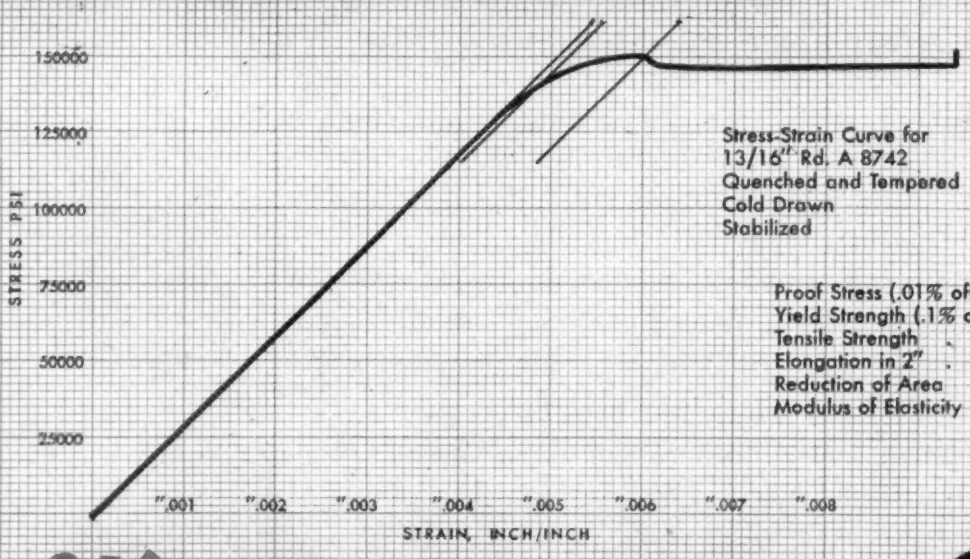

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Proof Stress (.01% offset)	144,500 psi
Yield Strength (.1% offset)	151,000 psi
Tensile Strength	152,500 psi
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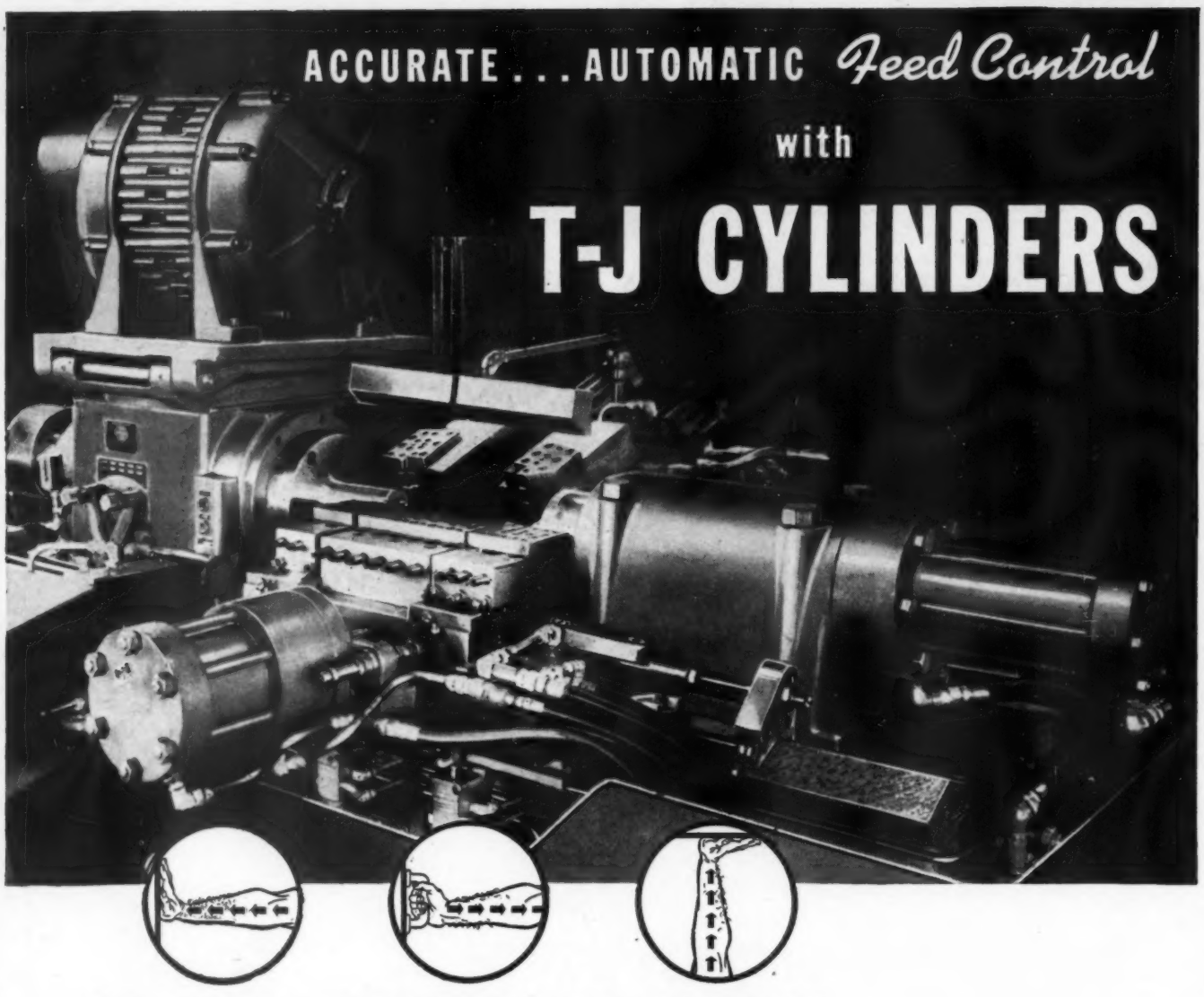
ACCURATE . . . AUTOMATIC *Feed Control* with T-J CYLINDERS



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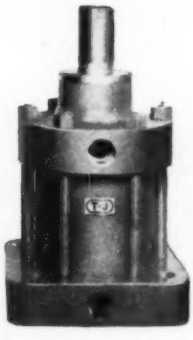
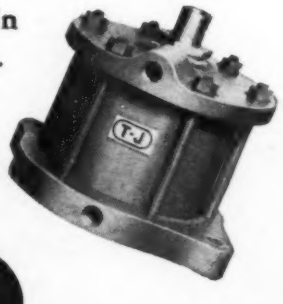


T-J Cylinders on this Sparks Hydra-Feed Lathe furnish automatic and accurate control for feeding the work to cutters in this multiple tooling set-up.

Another tough job—and T-J Cylinders do it *right!*

More and more today in industries throughout the nation . . . T-J Air and Hydraulic Cylinders are used to simplify operations and save time and labor. For pushing . . . pulling . . . lifting . . . clamping . . . 100 lbs. or 50,000 lbs. Available in many standard sizes and styles . . . both cushioned and non-cushioned types. Backed by 29 years' experience . . . T-J engineered to do the job *better* and *cut costs!* Write for latest catalogs. The Tomkins-Johnson Co., Jackson, Mich.



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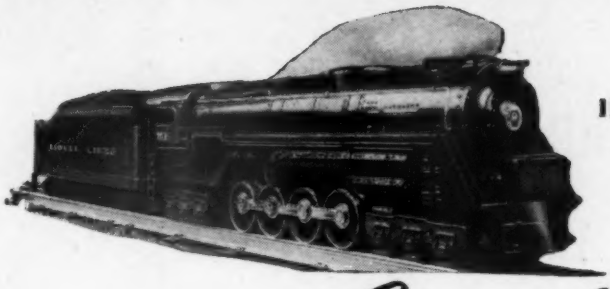

INDEPENDENT INVESTIGATOR TELLS HOW . . .

LIONEL *gives Assembly a clear track*

"We use Phillips Screws on 27 different products," Lionel's chief engineer told the Peck Co. investigator, on another study of assembly savings made by prominent manufacturers using Phillips Screws.

"PHILLIPS SCREWS ELIMINATE DRIVER SLIPS THAT USED TO COST A HALF MAN-HOUR EACH. On most parts for Lionel locomotives, cars, and accessories, the finish is applied before assembly, so that a driver slip meant disassembling the product and either junking the part or stripping off the paint for refinishing. The time lost would average about ½ man-hour per slip. This time is saved since we switched to Phillips Screws.

"PHILLIPS SCREWS MAKE DIFFICULT ASSEMBLIES EASIER, FASTER. Fastening the motor base inside the body of a model locomotive is one example. Space here is too small to allow holding a screw with the fingers. In many assemblies the space is too small to permit using even a screw holding attachment. Phillips Screws stay on the driver tip, make it a trouble-free, one-hand job.

"FINE APPEARANCE OF PHILLIPS RECESS IMPROVES APPEARANCE, and contributes to smart, modern design that appeals to our customers."

A WEALTH OF ASSEMBLY INFORMATION is available to you in the full report of this independent investigator's findings at the Lionel plant. Send for this and other reports, on metal, wood, and plastic products. Use coupon.

Fastening motor base to structure of Lionel model 182 electric crane with Phillips Screws. One push with a spiral driver finds the thread and sends home the screw without driver skids, and assembly slow-down.

The small flush-type Phillips Screw in the eccentric pin on this Lionel locomotive shows how the ornamental Phillips recess adds to smart, realistic design.

PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

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26 SOURCES

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New England Screw Co.
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Pheoll Manufacturing Co.
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Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
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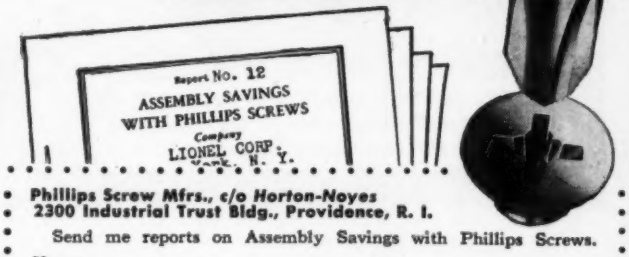

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BEARING DELIVERED COMPLETELY ASSEMBLED, ADJUSTED, LUBRICATED—READY TO SLIP ON SHAFT AND GO TO WORK.

THE SYMBOL THAT CAME TO LIFE

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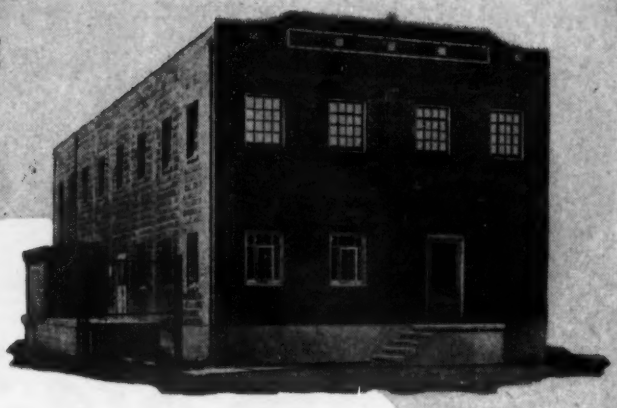
JESSOP

MALTA CARBIDE *and* T & V CAST ALLOY



are made here

Our new building for the manufacture of JESSOP "Malta" carbide and "T and V" cast alloy tools, dies, and wear resisting parts is a compact, highly functional unit which contains the latest production equipment. Engineering, production, and sales are closely coordinated under one roof for most efficient service.

are fully described here

Our new 24-page catalog, just off the press, contains illustrations, and complete specifications for JESSOP standard "Malta" carbide-tipped tools, tool tips, carbide inserted wire drawing dies, and "T and V" cast alloy tool bits. Also illustrated are "Malta" carbide form tools, dies, and wear resisting parts. Write today on your business letterhead for your copy.

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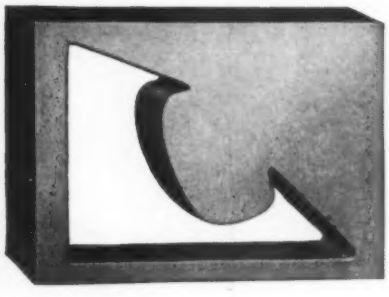
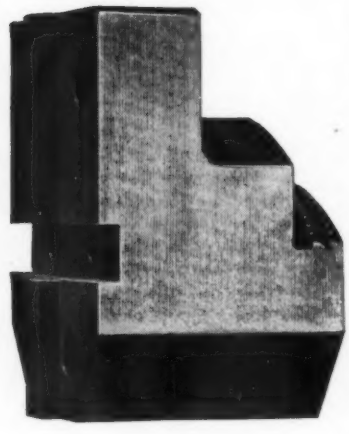
JESSOP STEEL CO.

WASHINGTON, PA.

BTR IS A Safe-Hardening TOOL and DIE STEEL





A steel that hardens safely—that quenches without cracking—is like money in the bank to the tool- and die-maker. That's why Bethlehem Tool Room (BTR) is the recognized leader in its field.

When there are drastic dimensional changes in the die or punch—when there are sharp, angular corners or round corners with small radii—when there are many holes separated by thin webs—play safe and insist on BTR.

Its safe-hardening characteristics are due in part to the following reasons:

(1) Balanced analysis of manganese, chrome, tungsten, and vanadium.

(2) Ability to oil-harden at relatively low temperatures.

Here is a steel that holds its size and shape in the heat-treating process. You'll find, too, that in the ideal quenching and tempering range, it hardens to a Rockwell C of 62-63. Moreover, it is easy to machine and is high in both wear- and shock-resistance.

BTR is an old, reliable performer. To minimize cracking dangers, always make sure that it's stocked in your tool room.

TYPICAL ANALYSIS:

C	Mn	Si	Cr	W	V
0.90	1.20	0.30	0.50	0.50	0.20

BETHLEHEM STEEL

BETHLEHEM TOOL ROOM . . . one of Bethlehem's *Big 8* Tool Steels

FREE LITERATURE

New Catalogs, Booklets, Bulletins

(Not good after February 1, 1947)

MACHINES AND ATTACHMENTS

1 LATHE—The Monarch Machine Tool Co., Sidney, Ohio. 36-page bulletin No. 1701 describes and illustrates Uni-Matic lathe. Photographs illustrate the versatile setups possible with the individually motor-operated tool slides.

2 DRILL & TAP GRINDERS—Gallmeyer & Livingston Co., Grand Rapids, Mich. 32-page bulletin describes Grand Rapids Drill and Tap Grinders with general discussion of construction features and detailed specifications of each model. Includes tips regarding care and use of twist drills.

3 MILLING MACHINE—The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. 36-page bulletin No. M-1606 illustrates and describes No. 2 MI plain, vertical and universal milling machines. Many detailed illustrations show design features.

4 MOLDING MACHINES — Watson-Stillman Co., Roselle, N. J. 8-page bulletin No. 641-A describes self-contained, hydraulically operated molding machines for thermo-setting plastics. Models range in size from 50 to 1200 tons.

5 TOOL GRINDER—K. O. Lee Co., Aberdeen, S. D. 24-page catalog describes "Knock-Out" line of universal tool grinders, and illustrates and describes equipment and fixtures available.

6 MACHINING PLASTICS — Durez Plastics and Chemicals, Inc., North Tonawanda, N. Y. 8-page bulletin "Machining Data on Phenolic Plastics" discusses tumbling, polishing, buffing, filing, sanding, grinding, milling, cutting, drilling, and other operations.

7 MICRO-DRILL PRESS — Massasoit Machine Co., Waltham 54, Mass. 4-page bulletin describes Lord & Davis high-speed precision drills for holes from 0.004 to 1/16 in.

8 BROACHING—Colonial Broach Co., Detroit 13, Mich. 172-page manual aand catalog includes section covering background, broaching fundamentals, types of broaching operations, uses of different broach types, broaching machines, and broaching accessories.

9 GEAR SHAVING—National Broach and Machine Co., Detroit 13, Mich. 4-page bulletin No. S46-7 describes application of shaving to camshaft gear production.

10 PRESSES — Air-Hydraulics, Inc., New York 13, N. Y. 8-page bulletin describes Air-Hydraulic presses for riveting, forming, light broaching, and other operations. Ram pressure is up to 5000 lb. and stroke is 1/16 to 5 in.

11 DRILLING AND TAPPING — Etco Tool Co., Inc., Brooklyn 6, N. Y. 16-page bulletin No. 31 describes Ettco-Emrick multiple drilling and tapping units which are made up on fixed centers of standardized interchangeable parts. The system will handle small parts requiring holes from wire sizes to 5/8 in. in steel.

12 FORGING HAMMERS — Lobdell Co., Wilmington 99, Del. 24-page bulletin illustrates and describes Lobdell-Nazel electro-pneumatic forging hammers. Description and specifications of each model are given and many illustrations showing varying applications.

TOOLS AND ACCESSORIES

13 CARBIDE TOOLS AND BLANKS —Vascoloy-Ramet Corp., North Chicago, Ill. 28-page catalog VR-400 lists and illustrates nearly 500 standard tools and blanks. Includes ten pages of data concerning coolants, speeds and feeds, and other tool engineering data.

14 ABRASIVES — Abrasive Products, Inc., South Braintree 85, Mass. 36-page catalog gives price list of abrasive papers and cloths. Includes illustrations and descriptions of various types.

15 REAMERS — Madison Mfg. Co., Muskegon, Mich. 32-page catalog covers adjustable reamers and bars with detailed drawings and data on each type.

16 LEAD MEASUREMENT — The Fellows Gear Shaper Co., Springfield, Vt. 12-page bulletin describes No. 12 H lead measuring instrument for checking the accuracy of helical and other surfaces.

17 TOOLS—Celfor Tools, Div. of Clark Equipment Co., Buchanan, Mich. 96-page catalog covers high-speed twist drills, reamers, and carbide cutting inserts. 28-page engineering data section discusses tool selection, tool capacity, and maintenance.

18 EXPANDING MANDRELS — W. H. Nicholson & Co., Wilkes-Barre, Pa. 4-page bulletin No. 1043 describes set jaw and straight jaw expanding mandrels for holding work on grinders, lathes, milling machines, and other equipment.

19 TOOL HOLDER—Bokum Tool Co., Detroit 21, Mich. 2-page bulletin describes tool holder with vertical adjustment for holding boring tools in lathes.

20 PYROMETERS — Wheelco Instrument Co., Chicago 7, Ill. 4-page bulletin D602-4 describes line of portable pyrometers with specifications for proper selection of extension holders, adapters and thermocouple tips.

21 PNEUMATIC TOOLS — The Aro Equipment Corp., Bryan, Ohio. 40-page catalog No. 46 describes 75 models in line of pneumatic tools. Includes grinders, drills, screwdrivers, nut-setters and impact wrenches.

22 GAGES—Size Control Co., Div. of American Machine & Gage Co., Chicago 12, Ill. 20-page catalog No. 846 illustrates, describes and gives prices on go and no-go plug and thread gages, snap gages, ring gages, twin-plug gages, and measuring wires. Gives data on salvage of war-time surplus gages.

HEAT-TREATING AND WELDING

23 ELECTRODES—Metal & Thermit Corp., New York 5, N. Y. 92-page catalog covers application, characteristics, physical and chemical properties, and recommended welding procedures for over 40 Murex arc welding electrodes. Includes data on estimating welding job costs.

24 DIELECTRIC HEATING — Raytheon Mfg. Co., Industrial Electronics Div., Waltham 54, Mass. 8-page bulletin describes and gives specifications for Model D5-G Raytherm dielectric heater. It has a power output of 5 kw.

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25 ELECTRODE SELECTION — Air Reduction Sales Co., New York 17, N. Y. 4-color chart, 25 by 40 in. gives data on electrode selection, shows currents, and gives mechanical properties.

26 FURNACES — The A. F. Holden Co., New Haven 8, Conn. 16-page bulletin "Holden Furnaces for Sodium Hydride Descaling" gives information covering technical phases of the sodium hydride process, and suggested types of equipment.

27 BRONZE ELECTRODE — Ampco Metal, Inc., Milwaukee 4, Wis. 6-page bulletin W-9 describes series of five heavy-coated shielded-arc aluminum bronze electrodes, Amco-Trode AC.

28 REFRACTORIES — Charles Taylor Sons Co., Cincinnati, Ohio. 12-page bulletin No. 201 describes Taylor Zircon Refractories for high temperature service and special applications.

29 SPARK WELDING—The Taylor-Winfield Corp., Warren, Ohio. 12-page bulletin 2-413 describes W-type rocker arm spot welders for foot, air and motor operation. 8-page bulletin 5-003 describes line of portable spotwelding equipment including manually-operated, air-operated, and hydraulically-operated guns.

PLANT SERVICE EQUIPMENT

30 ELECTRIC HOISTS — Manning, Maxwell and Moore, Inc., Muskegon, Mich. 36-page catalog No. 215-A describes Shaw-Box "Load Lifter" hoists which are made in sizes up to 20-ton capacity. 12-page bulletin No. 371 covers "Budgit" portable electric hoists which come in sizes to lift loads up to 2000 lb.

31 INDUSTRIAL TRUCKS — Yardman, Inc., Jackson, Mich. 6-page bulletin describes Model D Truck-Man, a floor truck which weighs 865 lb. and carries loads up to 2,000 lb.

32 METAL CLEANING — Optimus Equipment Co., Matawan, N. J. 8-page bulletin No. 6E1 describes standard models of metal cleaning and drying equipment. Table shows how 7 basic units can meet and handle 12 operating conditions.

33 MATERIALS HANDLING — The Elwell-Parker Elec. Co., Cleveland 14, Ohio. Series of four, 8-page bulletins describe respectively the logistics of boxes, barrels, bags, and bales. Each discusses the proper method of handling the various types of containers.

34 FLOOR TRUCK — The Rapids-Standard Co., Inc., Grand Rapids 2, Mich. 4-page bulletin No. TR-NSP-4 gives specifications and illustrations of Warehouser and Handy-Andy floor trucks.

PARTS AND MATERIALS

35 FASTENERS—H. M. Harper Co., Chicago 18, Ill. 105-page catalog gives complete data on non-ferrous and stainless steel bolts, nuts, screws, washers, and rivets.

36 FLEXIBLE COUPLINGS — Thomas Flexible Coupling Co., Warren, Pa. 58-page catalog describes complete line of couplings in which flexibility is provided by a slight bending of the disks which connect end flanges and center members.

37 COLOR CONDITIONING — Finishes Div., E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 32-page bulletin "Du Pont Color Conditioning for Industry" discusses fundamental principles of color. Photographs of installations illustrate functional treatment of machine tools.

38 SEAMLESS HOSE — Seamlex Co., Inc., Long Island City, N. Y. 2-page index sheet indicates the type of hose and couplings to use in standard applications.

39 METALS — Westinghouse Electric Corp., Pittsburgh 30, Pa. 48-page booklet gives properties and applications of 18 recent metallurgical developments including magnetic metals, electrodes, filaments, and contact metals, brazing and soldering alloys.

40 STEEL—Alan Wood Steel Co., Conshohocken, Pa. 8-page folder describes A. W. Dynalloy, a low alloy, high-strength, flat-rolled steel.

41 INDUSTRIAL BRAKES — Linderman Devices, Inc., Newburgh, N. Y. 4-page bulletin No. 460 describes industrial safety brakes which are said to eliminate self-energizing action.

42 CLAMPS—Knu-Vise, Inc., Detroit 16, Mich. 16-page bulletin covers toggle action clamps, pliers, and wrenches. It gives descriptions and diagrams of each classification of models produced.

43 BEARINGS—Nolu Oilless Bearing Co., Germantown 44, Philadelphia, Pa. 6-page bulletin describes hardwood bearings impregnated with lubricating oil which is released when the bearings are warmed.

44 CLAMPS — Marman Products Co., Inc., Inglewood, Calif. 20-page catalog describes line of standard and special clamps. Complete tabular data for all standard clamps are included.

45 NYLON RODS — The Polymer Corp., Reading, Pa. 5-page bulletin discusses properties and applications of nylon rods. Applications include valve seats, bushings, cams, gears, instruments shafts and insulators.

46 SELF-LOCKING NUTS — Elastic Stop Nut Corp., of America, Union, N. J. 16-page bulletin describes a procedure for testing the locking effectiveness of self-locking nuts and similar fastening devices. Included are tests for vibration, installation and removal torque, re-use torque, and wearing and plating.

47 STEEL — The Bissett Steel Co., Cleveland 14, Ohio. Catalog and handbook will contain seven sections covering various types of steel and engineering data. Three sections are now available.

48 HYDRAULIC EQUIPMENT — Hydro-Power, Inc., Springfield, Ohio. 8-page bulletin No. 460 covers high-pressure pumps, valves, controls, boosters, and packed power units.

49 CARBIDES—Kennametal Inc., Latrobe, Pa. 16-page booklet "Characteristics of Kennametal" describes the various compositions, characteristics, corrosion resistance, available shapes, and finishes obtainable. Also included are suggestions for designers.

50 CYLINDERS — Miller Motor Co., Chicago 18, Ill. "Hyd-Air" is a new 4-page house organ. First issue includes an article discussing tests on air-operated hydraulic booster.

51 TOOL AND DIE STEEL—Kropp Forge Co., Chicago 50, Ill. 8-page bulletin No. 946 describes series of five special steels developed for specific tool and die application.

52 CHUCKS, CYLINDERS, VALVES — Anker-Holth Mfg. Co., Port Huron, Mich. 64-page catalog covers "Airgrip" line of air and hydraulic chucks, collets, arbors and mandrels, cylinders, drill press units, valves and lubricating assemblies.

53 TEMPERATURE RECORDER — General Electric Co., Schenectady 5, N. Y. 8-page bulletin GEA-4572 describes Type SF-2 inkless temperature recorder. Applications are described and specifications and accessories are included.

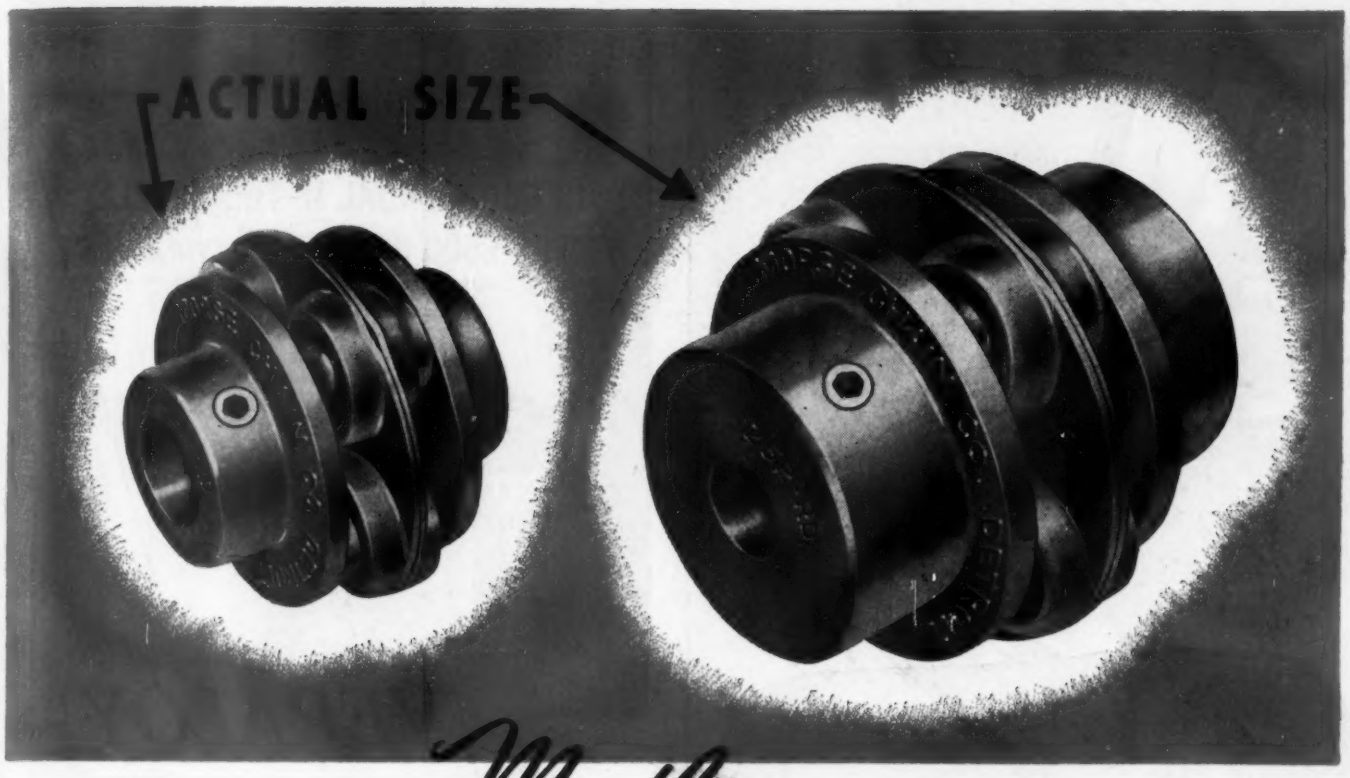
MISCELLANEOUS

54 MACHINE AGE—The DoAll Co., Des Plaines, Ill. Wall chart shows an arch of progress in which the keystone is machine tools as the basis of modern mass production. 60-page booklet "Your Life in the Machine World" supplements the chart and traces high spots of mechanical and industrial development.

55 RESEARCH—General Mills, Inc., Research Dept., Minneapolis 13, Minn. Magazine, "Progress Through Research" will be published quarterly. First issue includes an account of the mechanical division's contribution to the battle of Iwo Jima.

56 DECIMAL CHART—Rutland Tool Service, Detroit 3, Mich. Chart of decimal equivalents is 9 x 11 in.

57 COST REDUCTION—Designers for Industry, Inc., Cleveland, Ohio. Chart helps pick out cost items which need studies and gives remedies for 37 problems which contribute to high costs.



LITTLE *Morflex* COUPLINGS THAT DO BIG MONEY SAVING JOBS . . .

The new "junior members" of the Morflex Coupling family, shown above, improve performance in smaller power drives, in washing machines, home workshop power tools, power lawnmowers, small pumps and a multitude of other applications.

These "little giants" embody all the precision engineering qualities of their bigger brothers. Positive, direct power drive through exclusively Morse-designed Neoprene biscuit assembly saves power. This assembly, being soft and resilient, absorbs shocks, uneven impulses and vibrations. No lubrication necessary. No maintenance—Morflex is unaffected by gas, oil, dirt or weather.

Write Morse Chain Company, Detroit 8, Michigan, for complete information on these new, smaller, widely-useful Morflex Couplings.

MORSE CHAIN COMPANY, Detroit 8, Michigan • Ithaca, N. Y.

MORSE ROLLER and SILENT CHAINS and COUPLINGS

CM COMET

HOIST-POWER helps manpower to be more productive

Capacities from ½th to 1 ton. Available for plug-in on 110, 220 or 440 volt circuits. One-hand control. Prices from $130.

Materials handling is said to represent the largest single labor cost in industry—the largest single use of manpower. CM Comet Electric Hoists can make this same man (and woman) power more productive, more efficient and with less fatigue. From "receiving", through the production line, to "shipping", CM Comets are doing an outstanding job in making both ends meet. Write today for CM Bulletin 138 for the entire illustrated details.

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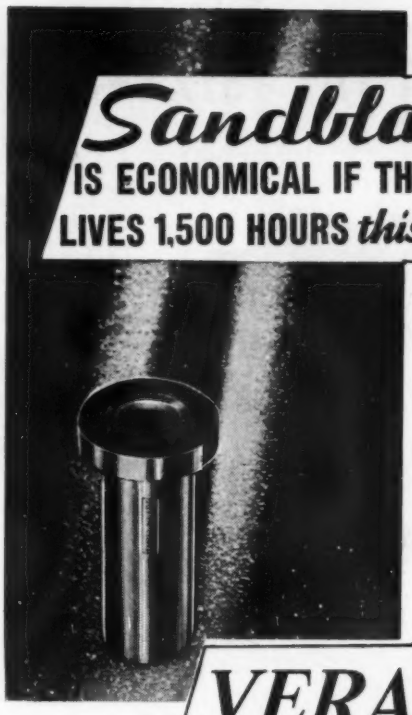
Sandblasting

IS ECONOMICAL IF THE NOZZLE LIVES 1,500 HOURS *this one does*



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an important factor in the design of new equipment

Production tools, process equipment, pumps, drives, etc. equipped with Split Ball Bearings can boast of trouble-free service and minimum shut down time when repairs are necessary.

For that new design or important redesign, investigate Split Ball, Thrust and Roller Bearings. New 32-page catalog on request.

Write for Bulletin AM-11-46.

·DIVISIBLE RACE BEARINGS·

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LEBANON, NEW HAMPSHIRE, U. S. A.

IMMEDIATE DELIVERY

on hydraulic pumps

-and we can do it!

If you're scheduling volume production involving hydraulic pumps, build your plans around Gerotor. We are prepared to deliver the pumps you need—when you need them! You can depend on Gerotor for timely arrival—for top performance, efficiency and versatility, too. Gerotor has the answer to your hydraulic pump problem—an answer that's ready now! Phone, wire or write.

GEROTOR MAY CORPORATION

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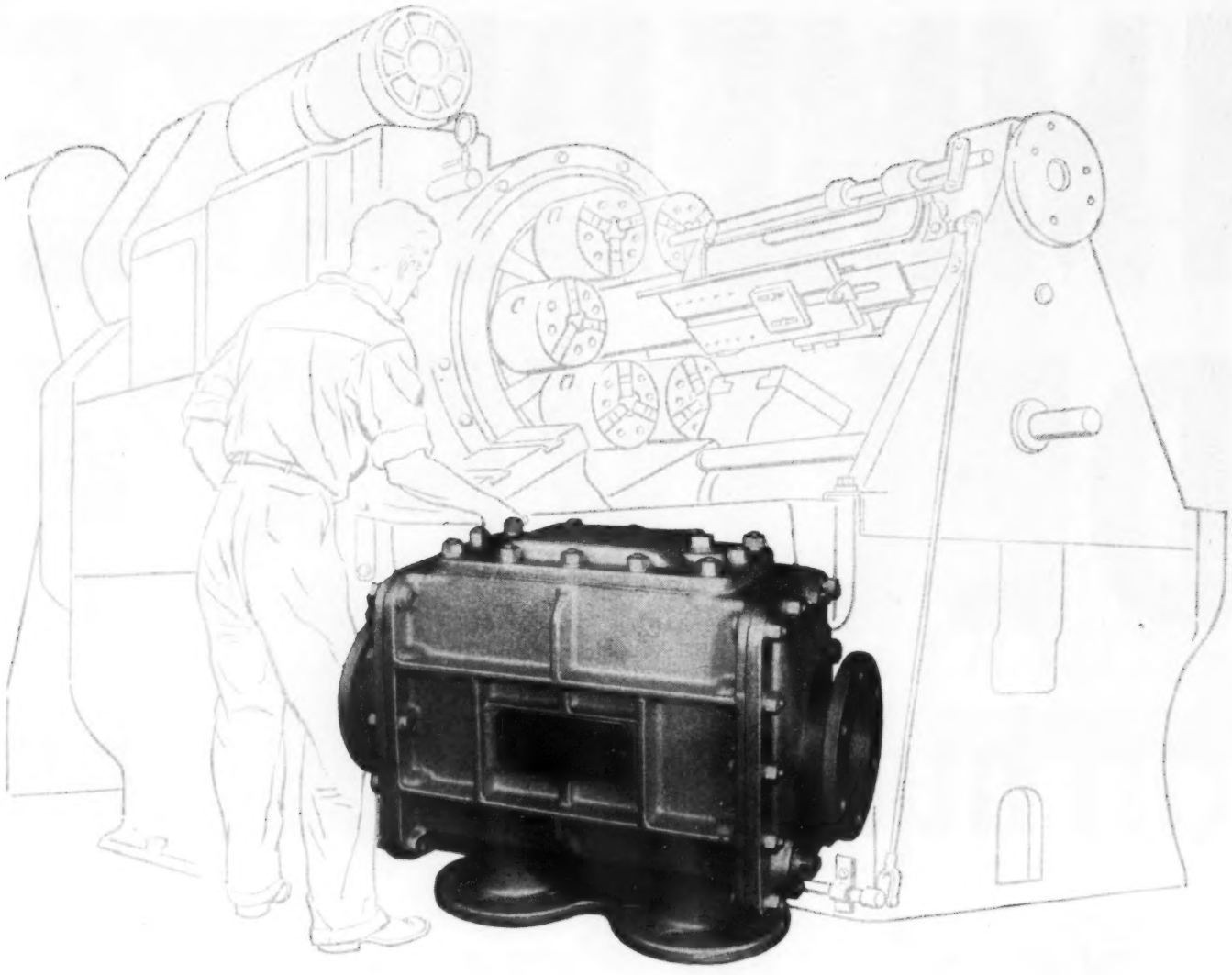
GEROTOR

HYDRAULIC PUMPS



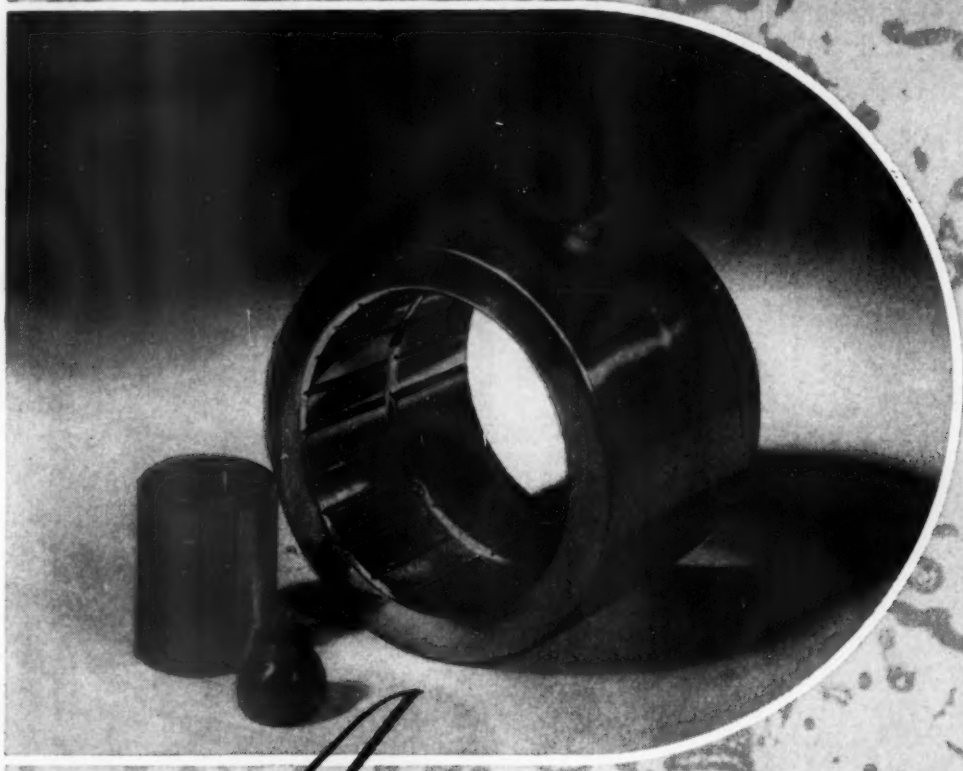
Harrison Oil Coolers Lengthen Machine Life

By maintaining lube oil temperatures within proper operating range, Harrison Oil Coolers increase the "life expectancy" of industrial installations. Bearings and other critical parts are protected against excessive wear. Production machinery functions more efficiently . . . with fewer breakdowns and less time lost for maintenance and overhaul.

Compact and sturdy, Harrison Oil Coolers are available in types and sizes to meet almost any industrial requirement . . . are contributing to better, more economical production in a wide variety of installations. Our engineers will be glad to discuss details with you in the light of your own requirements.

HARRISON

HARRISON RADIATOR DIVISION OF GENERAL MOTORS, LOCKPORT, NEW YORK



ABILITY to carry heavy loads in limited space is an attribute of the sleeve bearing. Typical of Bunting Bearings used for such applications are the crankshaft main, connecting rod and piston pin bearings of internal combustion engines. On your bearing problems, consult Bunting engineers. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in Principal Cities.

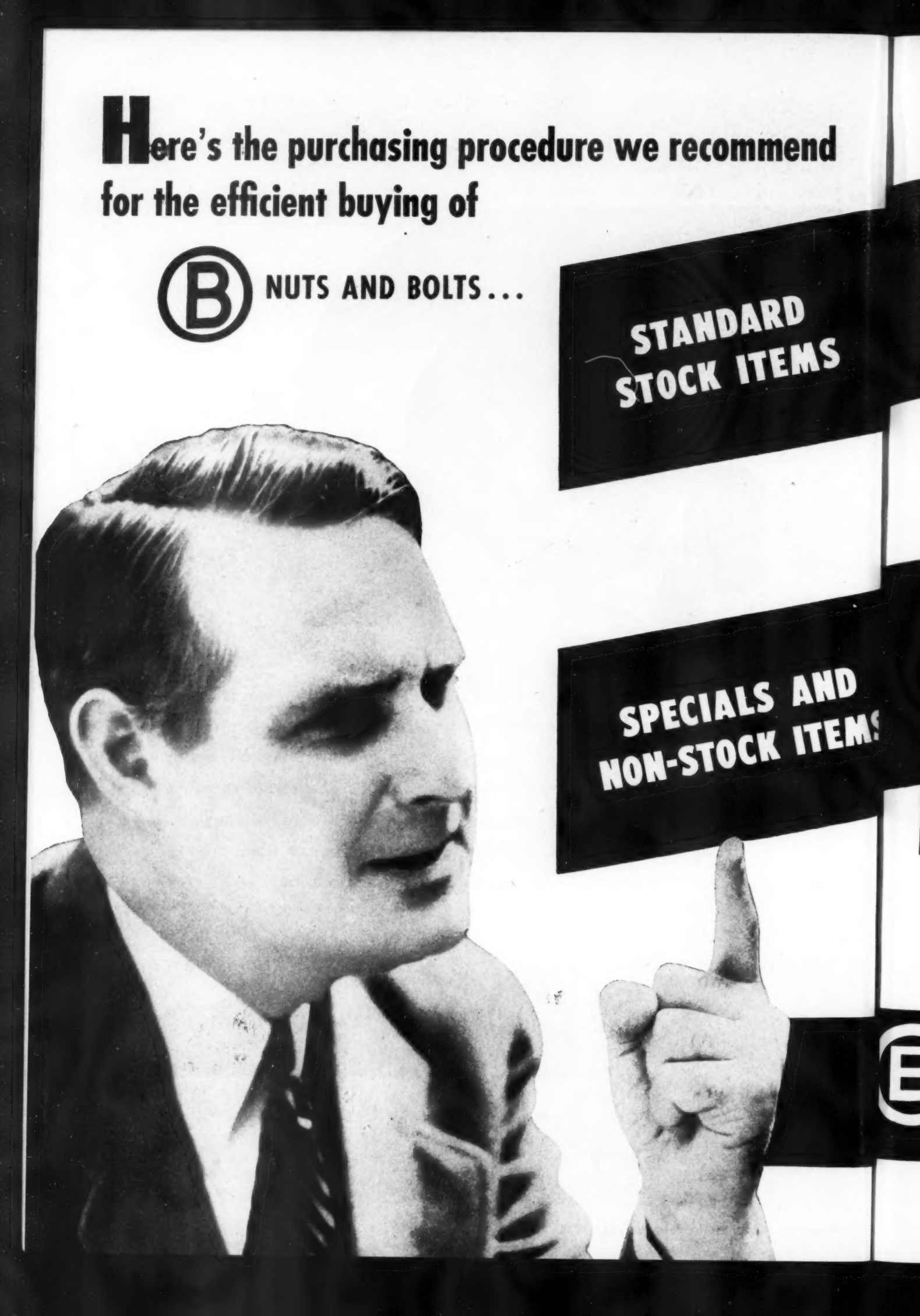
Bunting

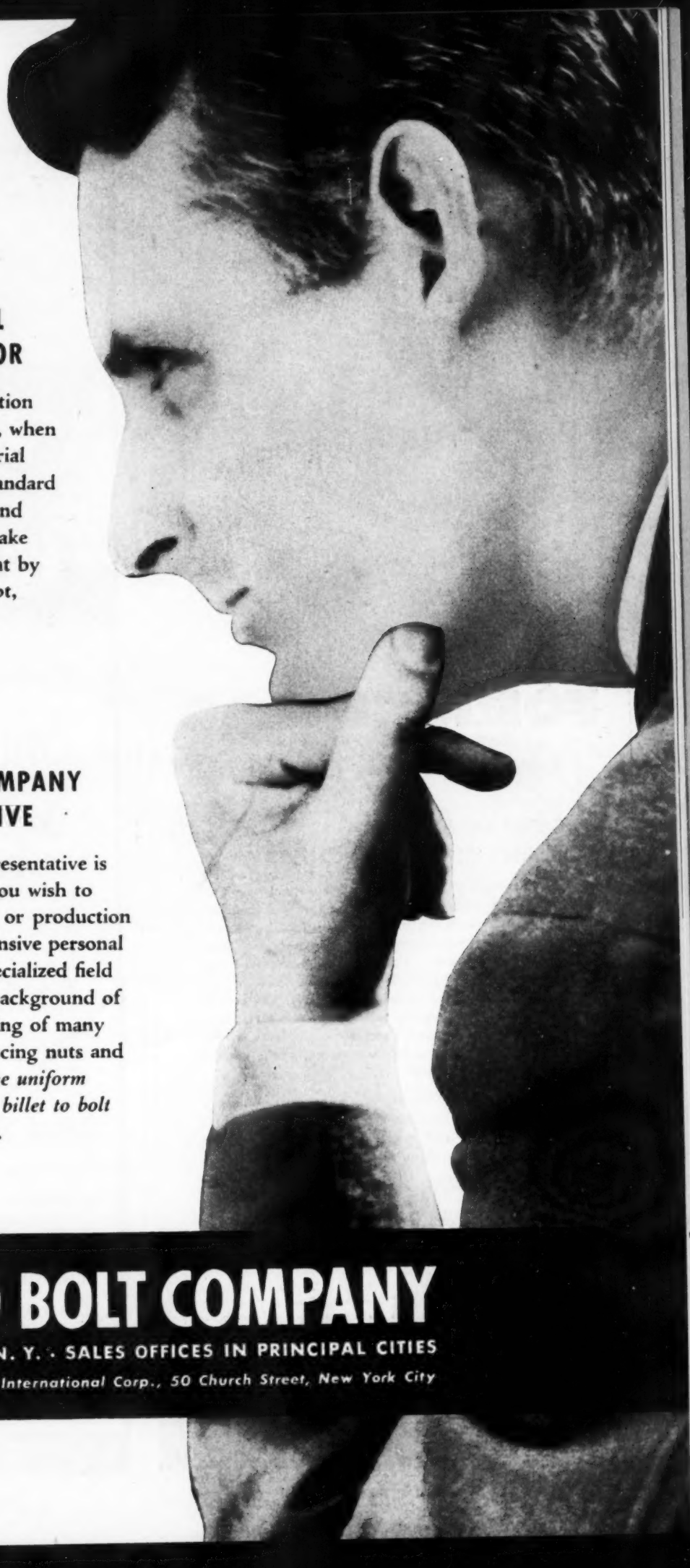
BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

52

Here's the purchasing procedure we recommend for the efficient buying of

NUTS AND BOLTS...





YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

No one is in a better position to give you what you want, when you want it than your industrial supply distributor. For all standard "stocked" Circle Ⓑ nuts and bolts, call him in. You'll make your purchasing more efficient by benefiting from his prompt, intelligent service.

BUFFALO BOLT COMPANY REPRESENTATIVE

Your local Circle Ⓑ representative is the man to see whenever you wish to purchase specials, non-stock or production items. Remember his extensive personal experience in this highly specialized field is backed up by a rich background of manufacturing skill consisting of many years experience in producing nuts and bolts of all types *of which the uniform quality is controlled from billet to bolt in one single plant.*

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NORTH TONAWANDA, N. Y. · SALES OFFICES IN PRINCIPAL CITIES

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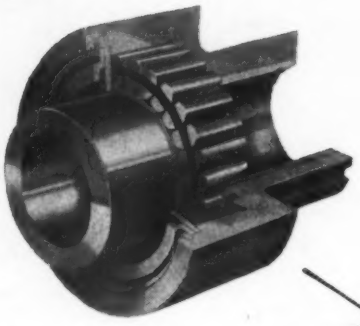
"More Hours of Trouble-Free Service"



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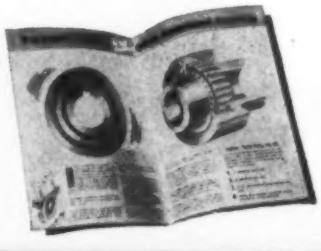
THE FULL COMPLEMENT
Over-Running Clutch

PROVED IN SERVICE— IN MANY LINES OF INDUSTRY

● In 1944 Formsprag was being laboratory tested. Now it has stood the test of actual operation under all sorts of conditions. Its design, whereby torque is transmitted through a large number of sprags, with positive, instantaneous engagement and disengagement up to hundreds of times a minute—has proved itself in many lines. Formsprag is enthusiastically endorsed by the manufacturers of bread wrapping machines, box making machines, spring coilers, canning machinery, punch press feeds, textile weaving machines, paper and rubber calendars, printing presses, dual power drives, dry cleaning equipment, machine tools and many other products.

One manufacturer writes, "We are very pleased with this clutch, and regard it as a tremendous improvement. We find that it has no faults, and expect it to give more hours of trouble-free service than the old style clutch."



Write for Illustrated Literature

We can serve you best if you give us a description of your operation, normal and maximum torque at specified speeds, the number of times per minute the clutch engages and disengages, and other pertinent information.

The GEAR GRINDING MACHINE COMPANY
DETROIT 11, MICH. U.S.A.

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USS STEELS SERVICE

When the call is for Steel—look to the

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WHATEVER your steel requirements are, you can depend on us to give you the best possible service. Our nine conveniently located warehouses try at all times to carry adequate, well-balanced stocks to fill your needs, and our engineers are available to help you solve problems of steel selection, application and fabrication.

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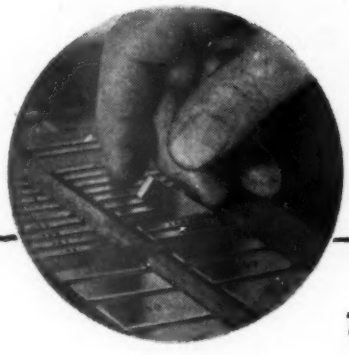
UNITED STATES STEEL

And Now... TAFT-PEIRCE

GAGE BLOCKS



TAFT-PEIRCE "A" ACCURACY GAGE BLOCK SETS

These are high-precision sets of "A" accuracy gage blocks—made from the very finest alloy steel, hardened and seasoned to insure durability and retain accuracy. And they are now available from the Taft-Peirce Small Tool and Gage Division, where they were made during the war years when gage blocks were otherwise unobtainable. Each set contains a complete assembly of gage blocks—all the 81 standard sizes—as well as an additional extra wear block of .10005″.

The size of each block is plainly marked on the edge for instantaneous recognition when the blocks are in use, or for quick selection when they are in their compactly arranged case. The case, as illustrated above, is so designed that any block can be readily removed with the fingers of one hand. And bear in mind that in buying gage blocks, Taft-Peirce gives you as always the *ultimate* in precision and long life.

STOCK DELIVERIES. PRICE $350.00.

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For Industrial Templates, Drawings, Charts and Maps

WITHOUT the USE of a CAMERA

DINOREFLEX
"IT HOLDS SIZE"
SAFETY FILM

★ Coated Plastic Base of Vinyl Copolymer which assures DIMENSIONAL PRECISION

Easily handled and stored—no breakage.

DINOREFLEX FILM is simply placed with the emulsion face of the film in direct contact with the copy and the back face of the film toward the light source. Exposure is through the back of the film. Normal photographic procedure is used to develop the negative image.

DINOCLOTH

Perfect for the projection printing of microfilm and engineering drawings.

Rapid handling; no curl; no warp; no distortion. Practical, economical, labor saving. Furnished in sheets or rolls.

DINOCLOTH is a water-proof, photographically sensitized tracing material—a photo-reproduction tracing cloth—with a silver halide emulsion on its face. An antihalation coating is added as a part of its back dressing which insures a clean sharp image.

You are invited to write or call upon us for complete and authoritative information.

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Lengthening the Life of a

"Caterpillar"

DIESEL TRACTOR

There's plenty of power, traction and stamina in this "Caterpillar" D2 tractor. For 13 hours a day, it pulls a 22-inch breaker plow through soggy, virgin marsh land. One important factor in assuring trouble-free service during the long, hard hours of operation is its sturdy, smooth-functioning BCA ball bearings.

Every BCA Ball Bearing is designed to do a specific job . . . carefully engineered to meet exact conditions of speed and load. These bearings increase equipment efficiency . . . extend equipment life. That is why "Caterpillar" and other manufacturers of long lived machinery have used BCA for years.

BCA engineers will be glad to assist you in selecting the bearings that are exactly right for your particular applications.

BCA **BEARINGS COMPANY OF AMERICA**
LANCASTER, PENNSYLVANIA

BCA

RADIAL • ANGULAR CONTACT • THRUST
BALL BEARINGS

LET LESS METAL MAKE MORE MONEY

It's expensive to hold a mechanism in place with unnecessarily big shoulders or collars,—or to temporize with small cotter pins, etc. Let us show you how spring steel retaining rings can do a thoroughly efficient job for you.

More and more retaining rings are being used in these days of necessary economy. Every ounce of metal and every cent of cost is more important today than ever before.

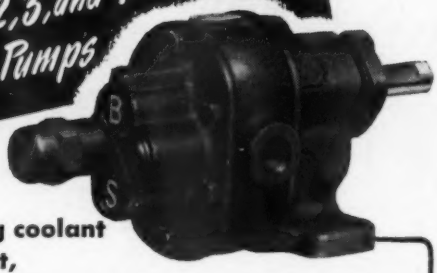
It is needless waste in most instances to turn your shoulders by cutting down larger shafts, when you can groove a smaller shaft and apply a spring steel retaining ring. You'll get excellent results at unbelievable savings.

Every shoulder on your machines or on your metal products should be examined to see whether or not smart engineering could take advantage of these modern artificial shoulders on shafts or in housings.

Write today for our descriptive folder on Retaining Rings.

THE NATIONAL LOCK WASHER COMPANY
Newark, N.J., Milwaukee, Wisc., U.S.A.

GENERAL PURPOSE PUMPS
Nos. 1, 2, 3, and 4 Rotary Geared Pumps



for supplying coolant and lubricant, for circulating purposes and transfer work

Well-known for their simplicity, reliability and economical performance, these pumps are ideal for handling lubricant or coolant. They are equipped with iron bearings which can be renewed easily in case of wear after long continued use. Available with or without integral relief valves. For complete information, write Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

B·S

We urge buying through the distributor

BROWN & SHARPE PUMPS

SELF-LOCKING NUTS

CAN YOU BE SURE THAT A PLAIN NUT WON'T SLYLY UNWIND ITSELF? If not, then what you need is the All-Metal, One-piece "Flexloc," which is a Self-Locking Nut and won't budge, except when a wrench is used.

The "Flexloc" packs maximum usefulness in minimum space by being rugged, locked, compact—and is therefore, becoming increasingly popular.

Every thread—including the locking threads—takes its share of the load.

It covers a wide range of tolerances—from low #1 to high #3.

It can be used over and over again without losing much of its locking ability.

Being a "stop" nut, it stays locked in any position on a threaded member.

"Flexloc" Thin Nuts are especially popular.

Sizes from #6 to 1" in diameter—millions in use!

Convince yourself with a few free samples.

OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.
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Boston • Chicago • Detroit • Indianapolis • St. Louis • San Francisco

The brush-off that paid off

A SHORT TIME AGO one of our salesmen got the brush off; he lost an important order that he was very anxious to get. He had helped work out a method of using Osborn brushes which increased his customer's operating efficiency. The customer adopted the idea but he bought a competitor's product because Osborn's price was, or so it seemed, 50% higher.

Our man found it pretty hard to believe that his price was so far out of line, so he did some investigating. Osborn's price was indeed higher (47¢ per brush section as against 30¢)—*but operating comparisons showed the Osborn brushes gave three times the service.*

The legitimate comparison therefore was 47¢ against 90¢, in Osborn's favor. That original "brush off" is going to pay off now—for both Osborn as supplier and the Customer as user—because it caused the investigation which showed up the true costs involved.

Whenever you have an operation where power brushing can help speed production, improve product, and lower costs (practically all manufacturers have them!)—it will pay you to check Osborn, the world's leading industrial brush maker.

THE OSBORN MANUFACTURING COMPANY

5401 Hamilton Avenue Cleveland, Ohio

Osborn Brushes

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

Better Grinding

★ Greater Production
★ Finer Finish
★ Longer Wheel Life

...by the barrel

CODOL Liquid Grinding Compound has often proved to be the primary factor in turning an unacceptable performance into a complete success. One user said: "When Codol replaced another fluid for grinding a crankshaft, wheel life jumped from 14 to 20 pieces and gumming disappeared." Says another: "Of seven compounds tested, Codol produced the best finish." And another: "Since standardizing on Codol for surface grinding, wheel and segment life has improved and rusting has been eliminated."

A Stuart Engineer will help you apply Codol to your advantage, whatever your grinding problems may be. Ask him to visit you.

Write for "Up-to-Date Grinding Practice"

D.A. Stuart Oil Co. LIMITED
EST. 1865
2729 SOUTH TROY STREET, CHICAGO 23, ILL.

Stuart Oil Engineering Goes With Every Barrel

SPEED CUTTING OPERATIONS

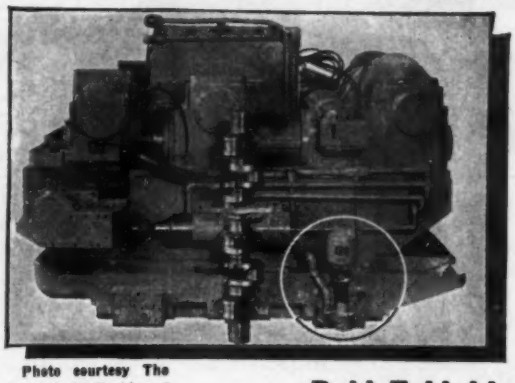


Photo courtesy The Crankshaft Machine Co.

WITH

RUTHMAN GUSHER COOLANT PUMPS

Model TL 7328

To speed production on metal cutting operations turn to Gusher Coolant Pumps.

Illustrated is a "MELLING" TYPE CRANKSHAFT CONTOUR TURNING LATHE," made by the Crankshaft Machine Company and equipped with a ⅓ H.P. MODEL SLO-7230 RUTHMAN GUSHER COOLANT PUMP.

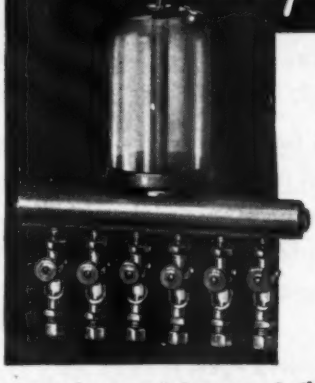
Satisfied customers are your guarantee of the service a "GUSHER" will give you. Always specify them on your machines.

Write for Catalog 10A

THE RUTHMAN MACHINERY CO.

1809 READING ROAD, CINCINNATI, OHIO

MULTIPLE LUBRICATION *Simplified*



Here you have only one receptacle to watch and keep filled—a time saver and an assurance of dependable lubrication. Gits "MD" Sight Gravity Feed Multiple Oiler is a simple, practical and economical means of lubricating from 3 to 12 individual points from a central reservoir. Large capacity, transparent unbreakable plastic reservoir provides clear vision of oil contents at all times. A shut-off valve is located at the top of the transparent reservoir to prevent oil flow to the horizontal oil chamber when machines are not operating. Each drip fitting is equipped with an individual needle valve adjustment for regulating flow of oil, which can be locked against vibration. Ask for complete information on range of models and prices. Gits Catalog No. 60 illustrates and describes a full line of Oilers, Oil and Grease Seals and Lubricating Devices—write for your copy.

GITS BROS. MFG. CO.
1857 South Kilbourn Avenue, Chicago 23, Illinois
Exclusive for over 35 years

Over 20 years ago
we ran an advertisement which read:

"GEARS WE CAN'T MAKE AIN'T"

...TODAY THAT STATEMENT IS MORE THAN EVER TRUE

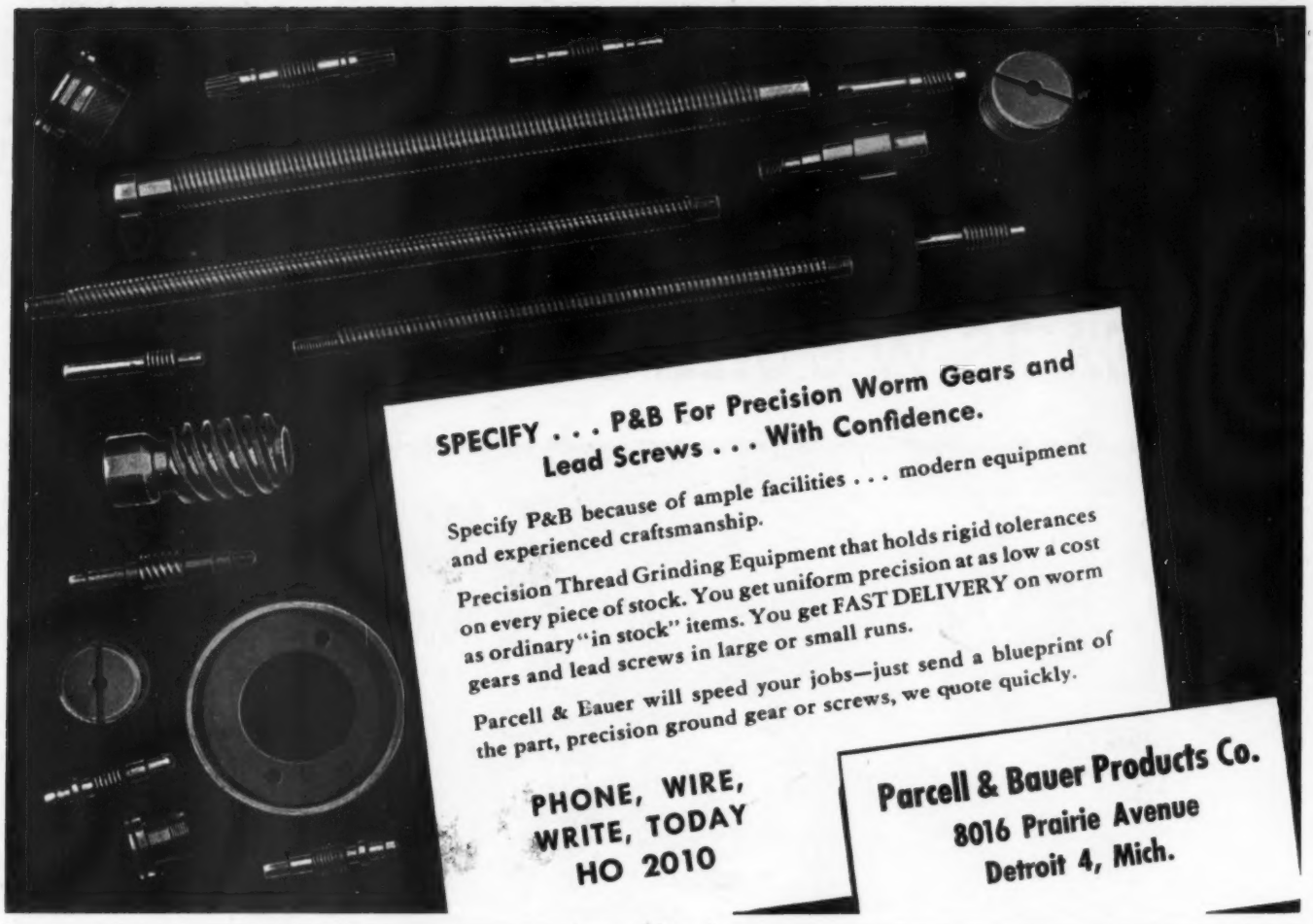
Yes, since the appearance of that advertisement, we've more than quadrupled our floor space—added hundreds of new gear cutting machines (for making every type and size of gear)—improved our shop facilities—added "special" machines, systems, and methods to improve and expedite our work—and since that time, we have designed and sold thousands upon thousands of Speed Reducing Units and our famous LimiTorque Automatic Valve Operators.

So, since we made our first gear back in 1892, we've "come a long, long way" in those 54 years. Today, we can make any size or type of gear, in any quantity, and of any material: Spur, Herringbone, Spiral-Bevel, Curved Tooth Spiral-Bevel, Hypoid, Internal, Intermittent, Non-Metallic; also, Racks, Ratchets and Pawls, etc.

Send for the latest Gear Book No. 46.

Philadelphia
GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls



SPECIFY . . . P&B For Precision Worm Gears and Lead Screws . . . With Confidence.

Specify P&B because of ample facilities . . . modern equipment and experienced craftsmanship.

Precision Thread Grinding Equipment that holds rigid tolerances on every piece of stock. You get uniform precision at as low a cost as ordinary "in stock" items. You get FAST DELIVERY on worm gears and lead screws in large or small runs.

Parcell & Bauer will speed your jobs—just send a blueprint of the part, precision ground gear or screws, we quote quickly.

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Parcell & Bauer Products Co.
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Detroit 4, Mich.

Try ATLANTIC

on that gear order

Many others have, to their lasting satisfaction. Full equipment, splendidly trained personnel, precision inspection, in spurs, helicals, worms, bevels, herringbones. Any gear material including Micarta or non-metallic Bakelite. Any quantity. Any size to 60". Send us your specifications.

Send us your blueprints or samples for our quotations and delivery dates. F-22

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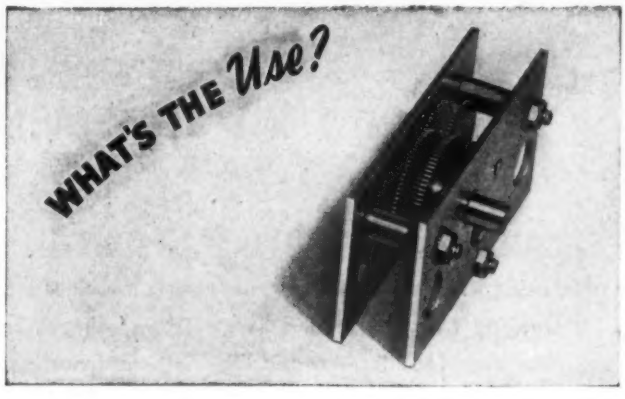


In selecting the *right* gears for the job, it is important to know how they will be used — the conditions under which they must operate.

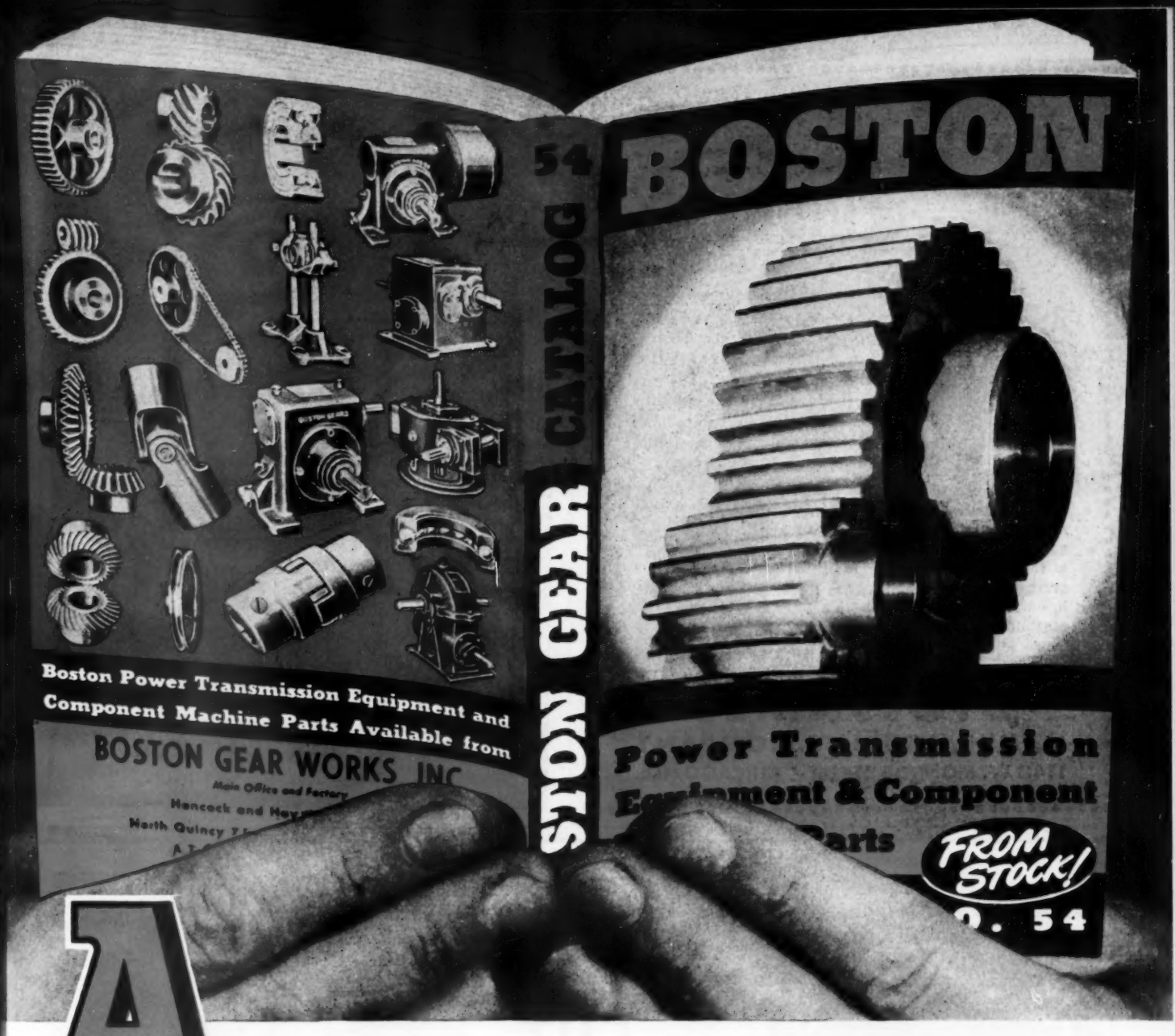
Beaver Gear Engineers, knowing what is expected, and trained to assist in details of fine-pitch gear applications, can tell you what will work best under various conditions and can specify the correct design.

Beaver modern production facilities and experienced craftsmen assure you of gears made correctly to specifications.

Write for latest bulletin describing Beaver Gear Facilities and Methods.

Beaver Gear Works Inc.

1026 PARMELE ST. **ROCKFORD, ILLINOIS**



ANNOUNCING CATALOG 54

Just off the press — this new catalog on Boston Power Transmission Equipment and Component Machine Parts — contains complete specifications on all stock sizes of gears, speed reducers, sprockets and chain, couplings, pulleys, pillow blocks, shaft supports, ball bearings, universal joints, pinion wire, rack, etc. — a valuable handbook to have.

WRITE FOR YOUR COPY OF THIS NEW CATALOG

BOSTON GEAR WORKS, INC.

NORTH QUINCY 71, MASSACHUSETTS

Please send me_____copies of your NEW catalog 54.....

Name_____

Company_____

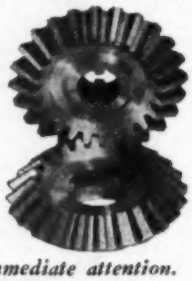
Street_____

City and Zone No._____ State_____

GEARS
For INDUSTRY

Since 1888 . . .

We have been making many types and sizes of gears for industry. Vast plant facilities of the most modern gear cutting equipment assure capable handling of your *production* or *special* gear requirements.



HELICAL GEARS—Made from 1" to 60" in diameter and from 24 DP to 1½ DP.
BEVEL GEARS—Size range from 1" to 60" in diameter and from 24 DP to 1½ DP.
SPUR GEARS—Size range from ¾" to 150" in diameter. 32 DP to ¾ DP.
WORM GEARS—Made from 1" to 100" in diameter and from 24 DP to 1 DP.
MACHINE CUT RACKS—Cut in any length with teeth of 24 DP to 1 DP.

Your gear inquiries will receive immediate attention.

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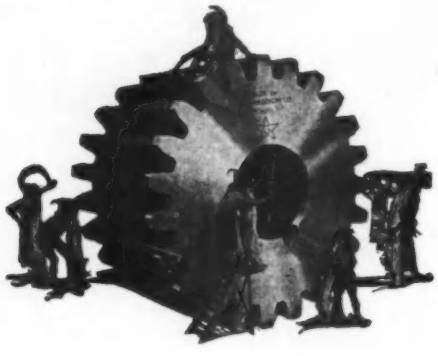

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Better Gear Products

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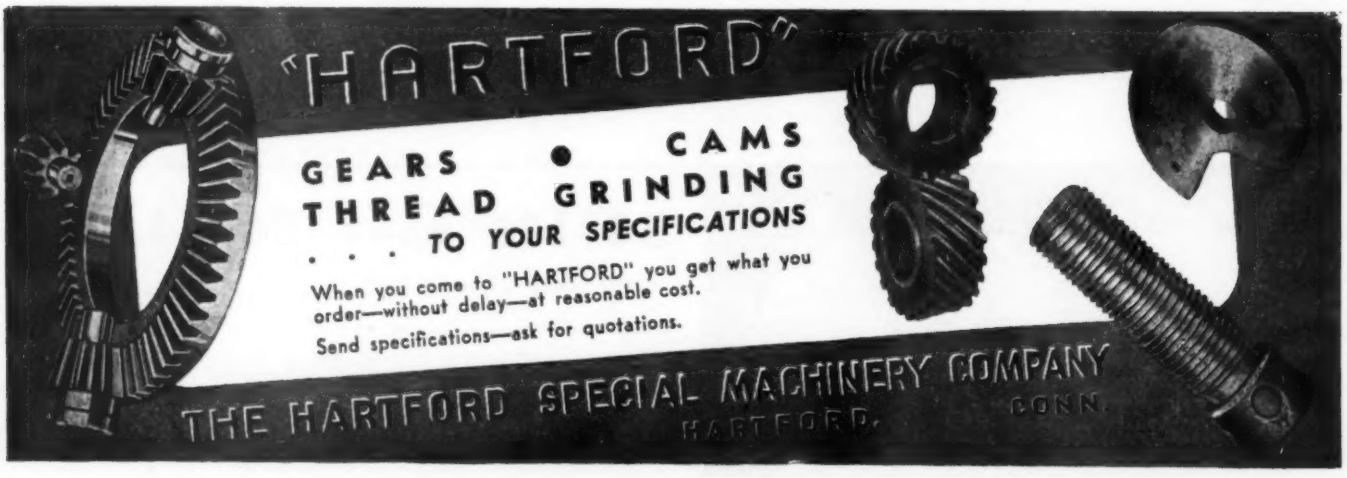
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FB-351

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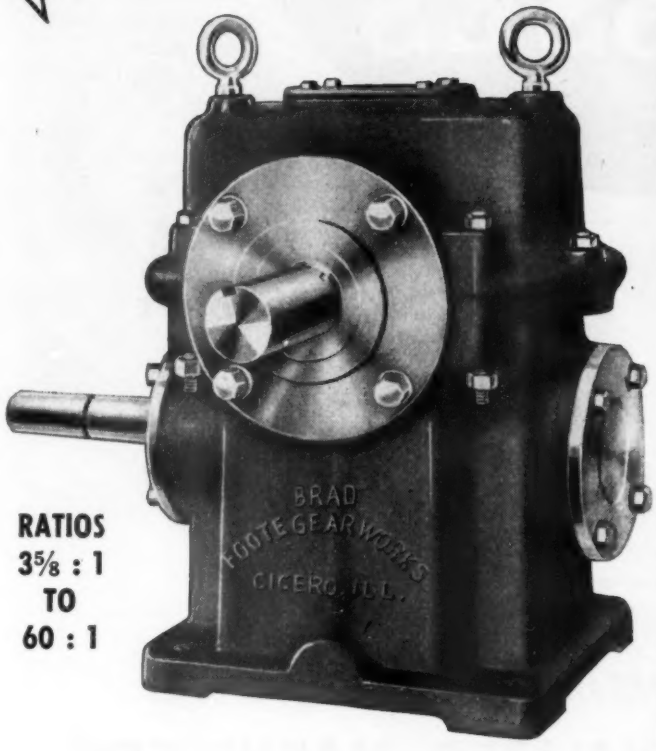

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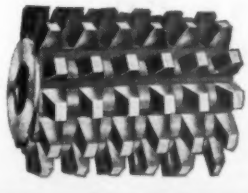

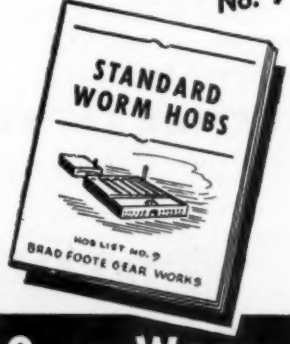

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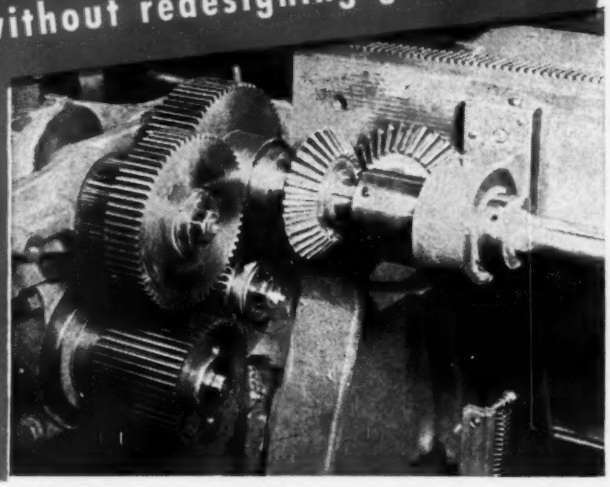

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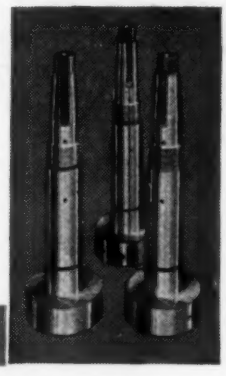

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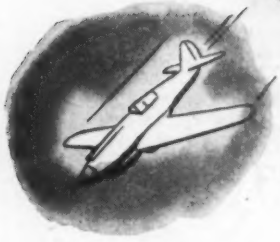
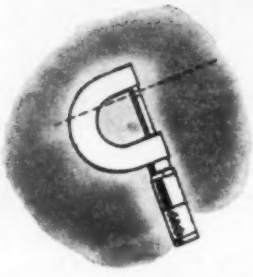


HIGH SPEED



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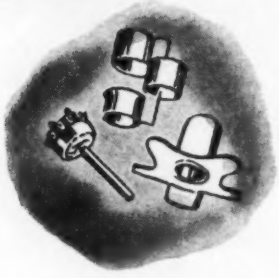
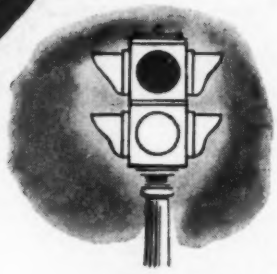
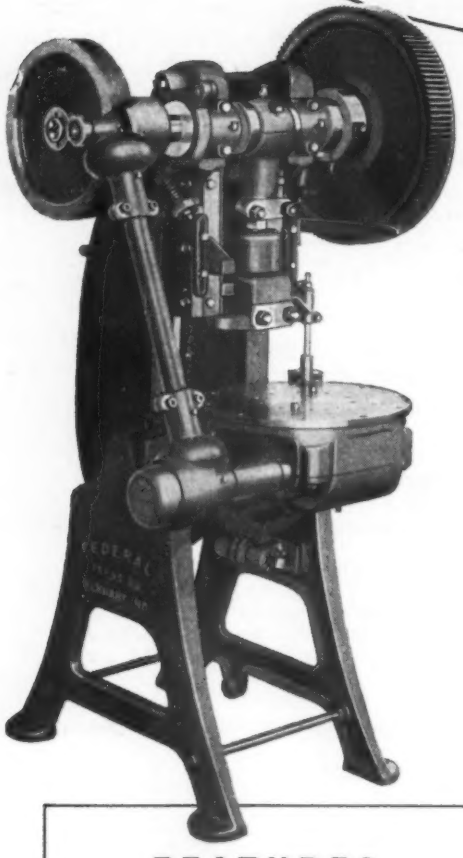


VERSATILITY



SAFETY



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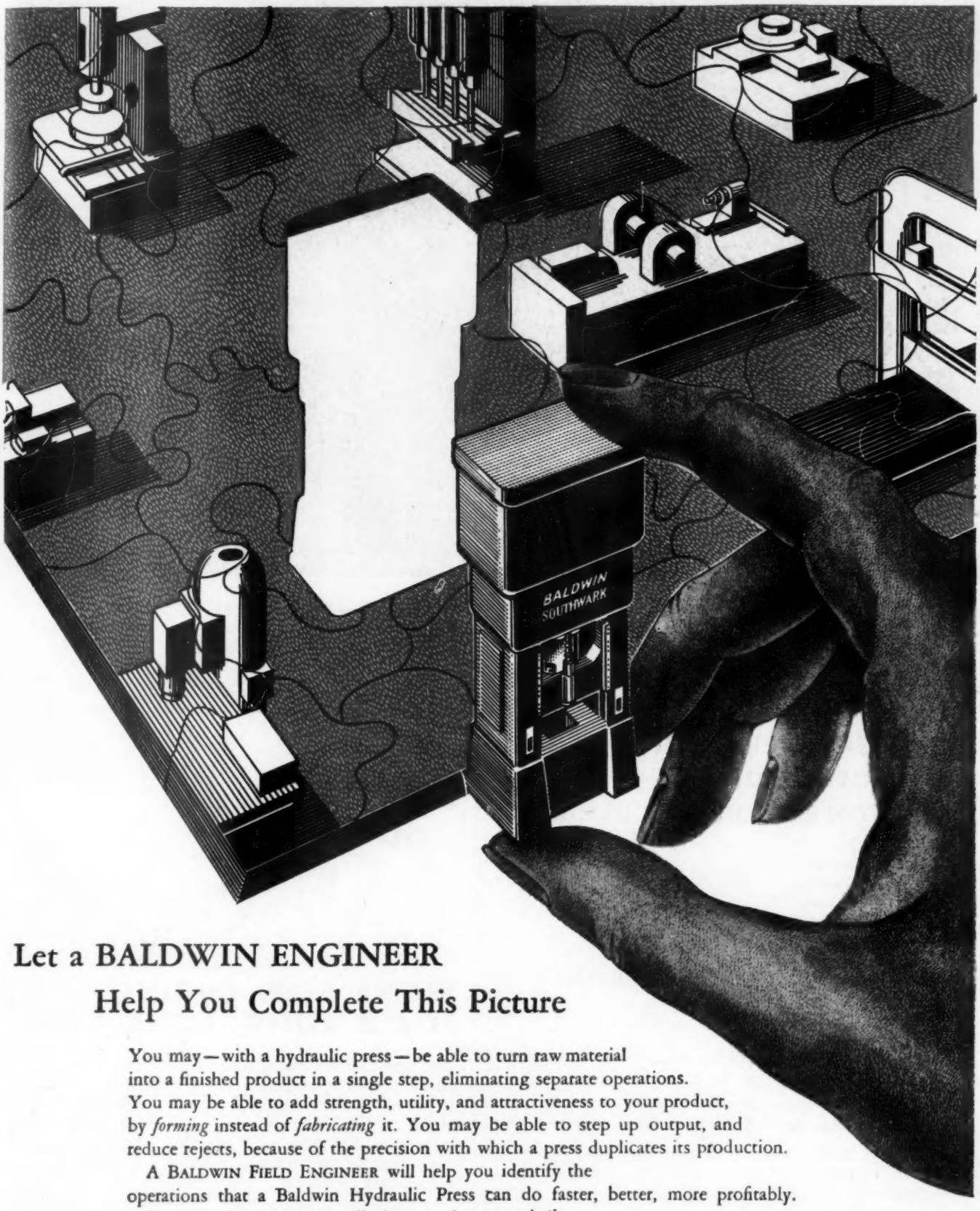

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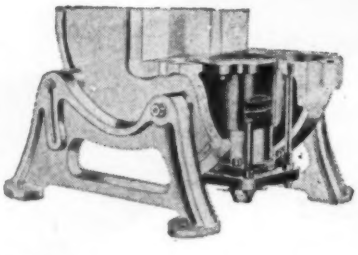

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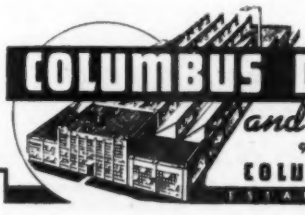

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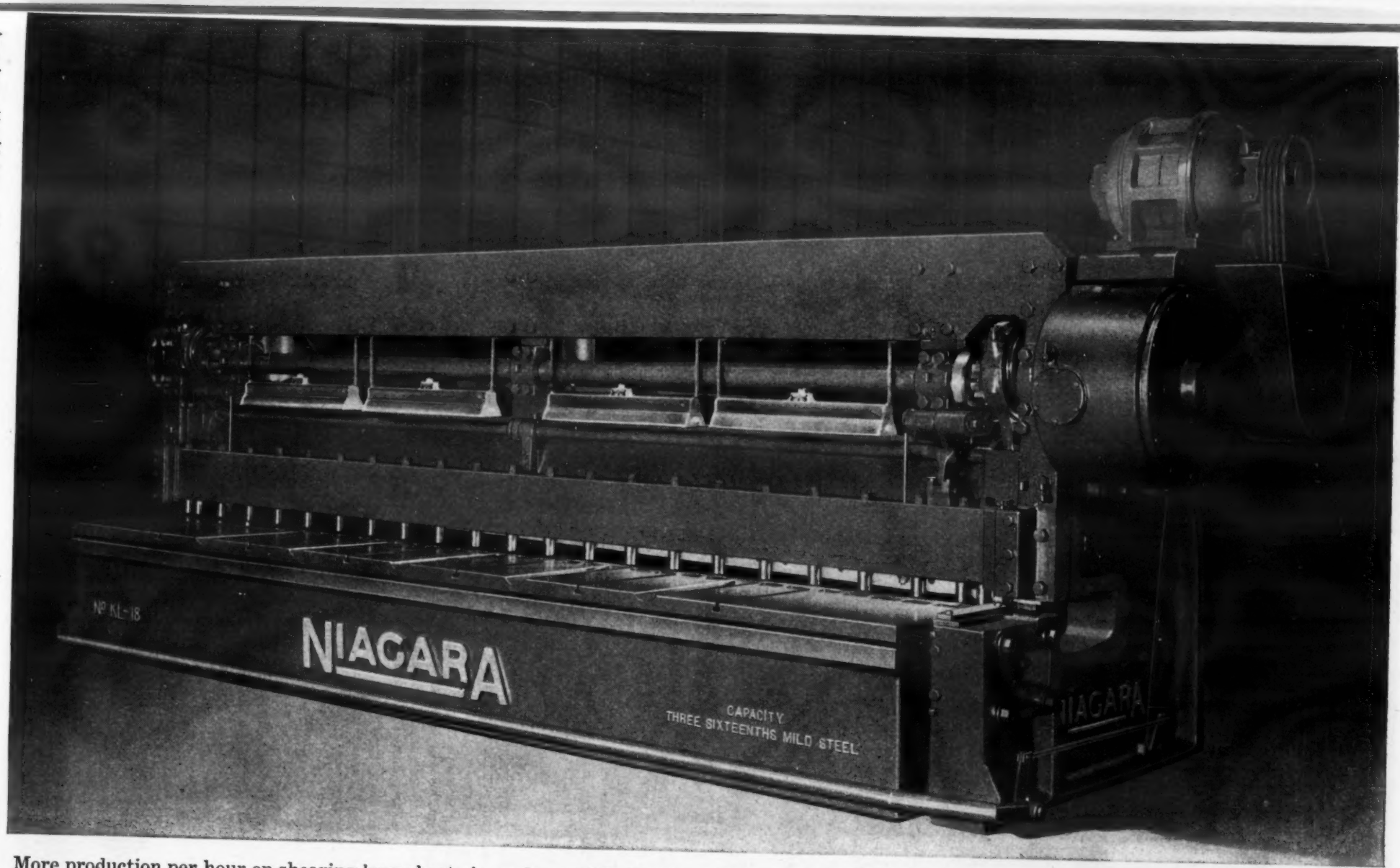

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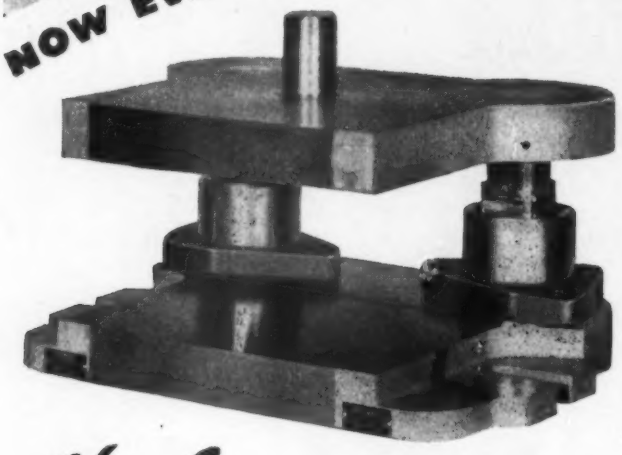

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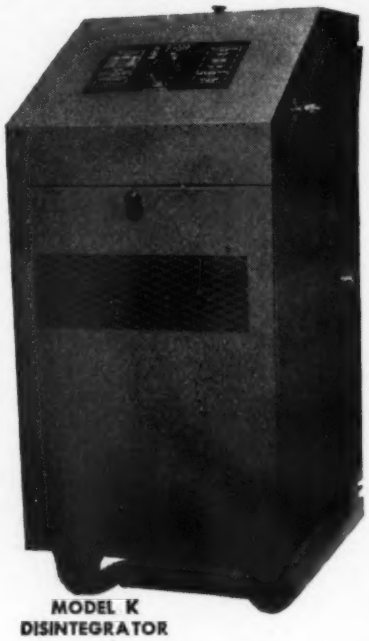
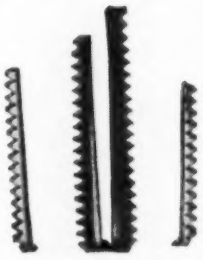


MODEL K DISINTEGRATOR



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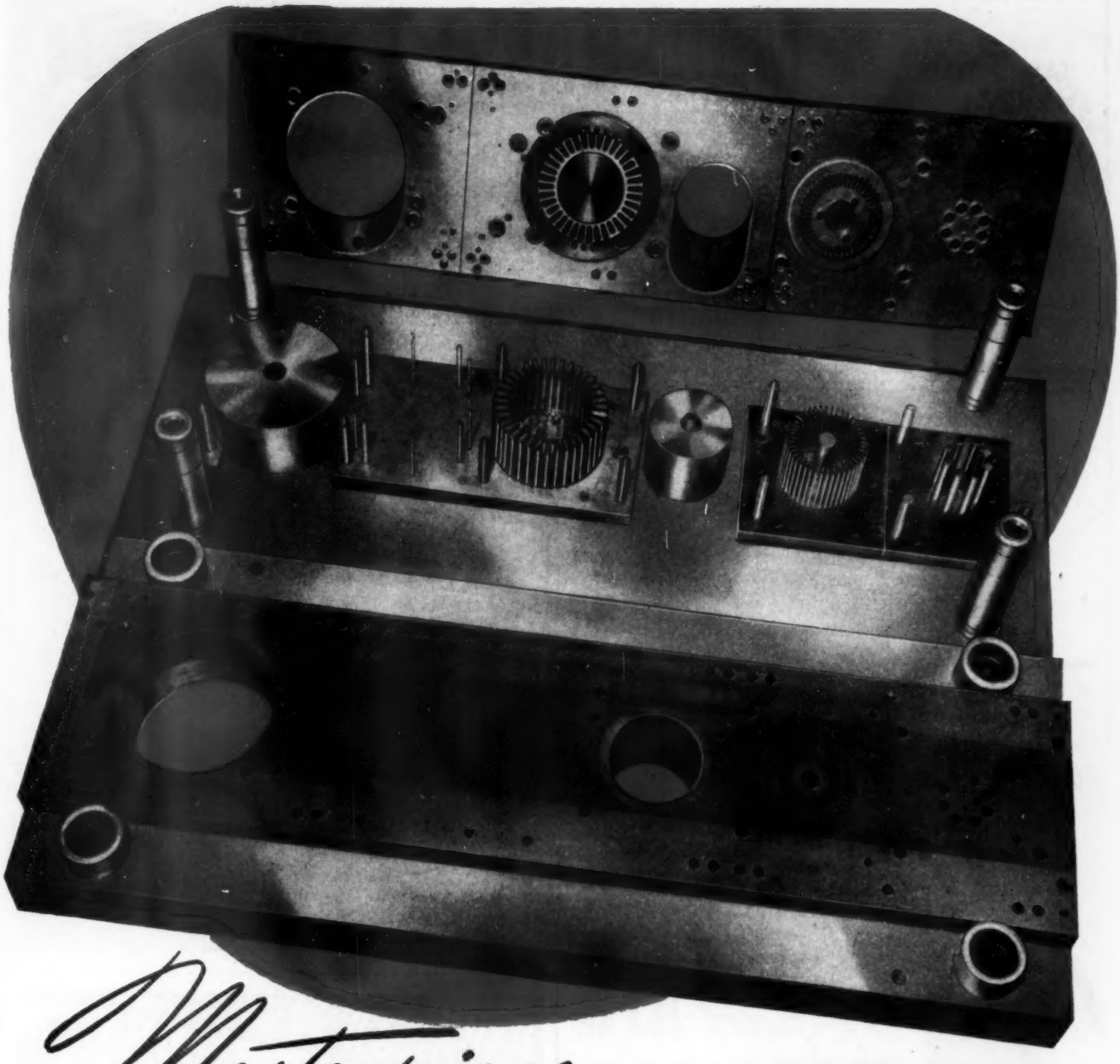

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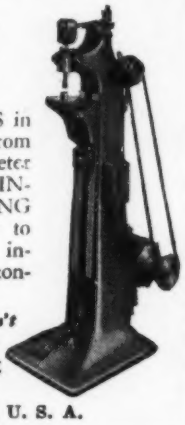

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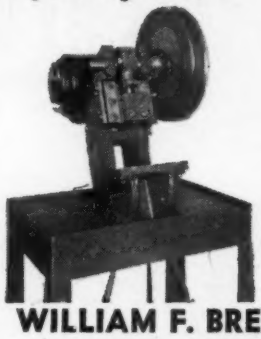
for high speed, low cost Stamping, Punching and Riveting—
AVAILABLE FOR IMMEDIATE DELIVERY



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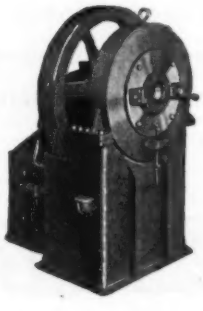

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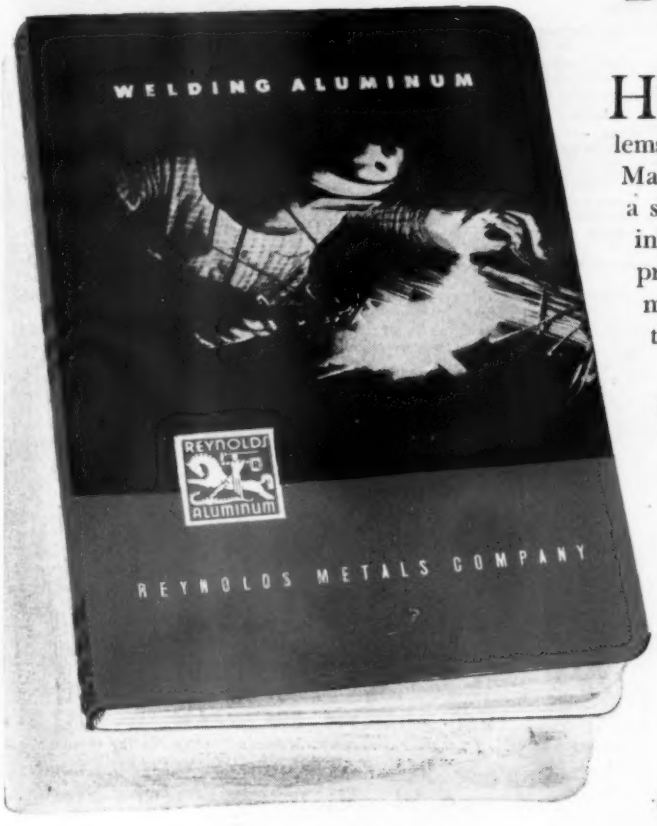

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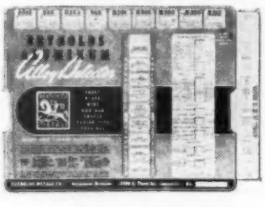

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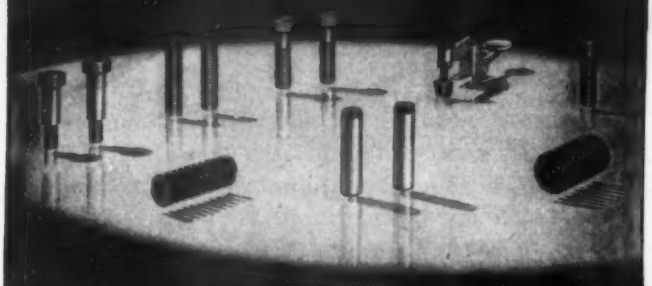

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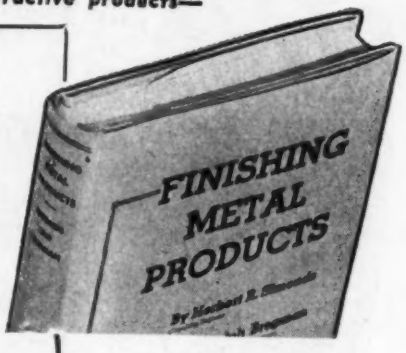

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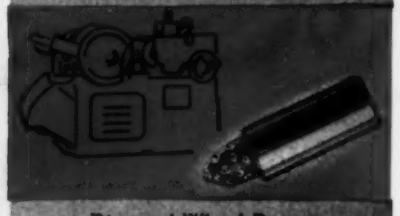
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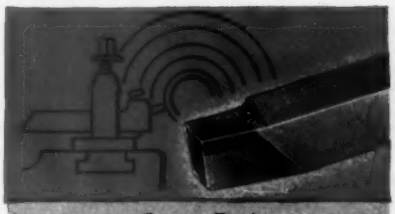
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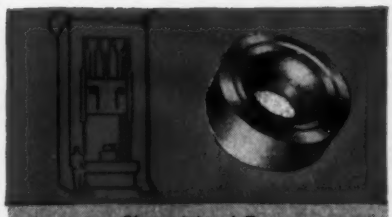
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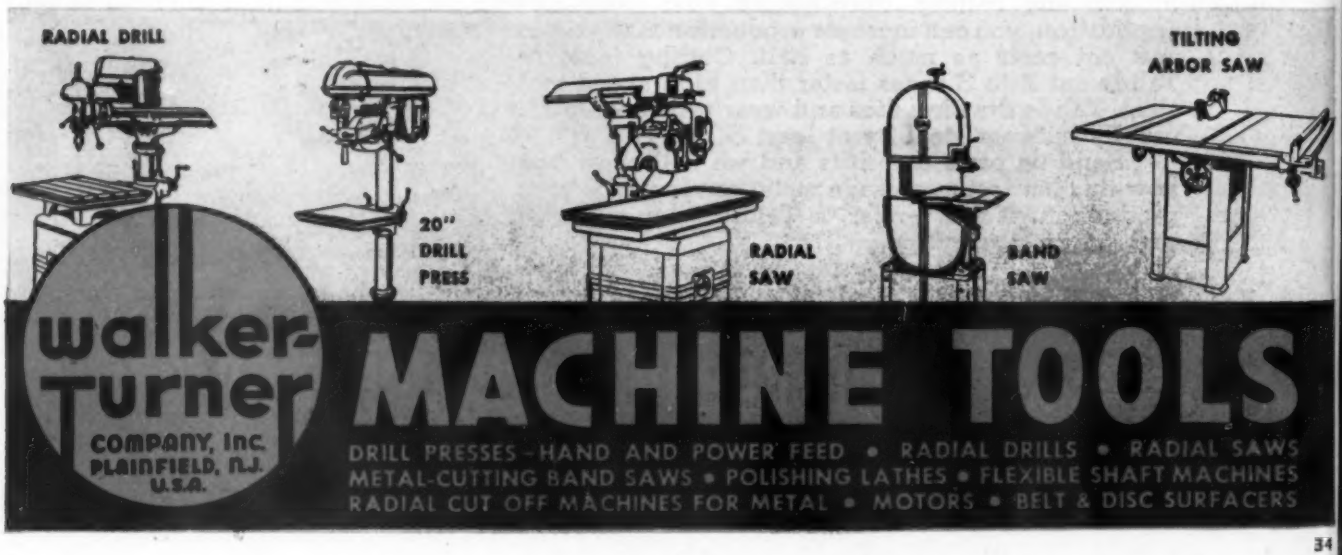
In seven years some say—but in modern production practice it is not a question of years or how much the machine has earned or still owes you. The question is, will your equipment enable you to compete with the new, faster working, more efficient and flexible layouts in your competitors' plants.

A five-year-old Machine Tool is "washed up", for instance, if it can be replaced by one costing a few hundred dollars that will write itself off in less than a year through improved production. That's the story of Walker-Turner Machine Tools wherever metals, wood or plastics are drilled, cut or shaped.

These machines are "light" only in weight and price. Their production output in the past eight years has astounded the management of thousands of plants—large and small—throughout the country.

A key to high manufacturing efficiency and **low manufacturing costs** is the modern, flexible, light machine tool. It represents small capital investment, flexibility of operation, increased productivity and low operating costs.

Walker-Turner Machine Tools are sold only by authorized Industrial Machinery Distributors. A general catalog will be sent on request.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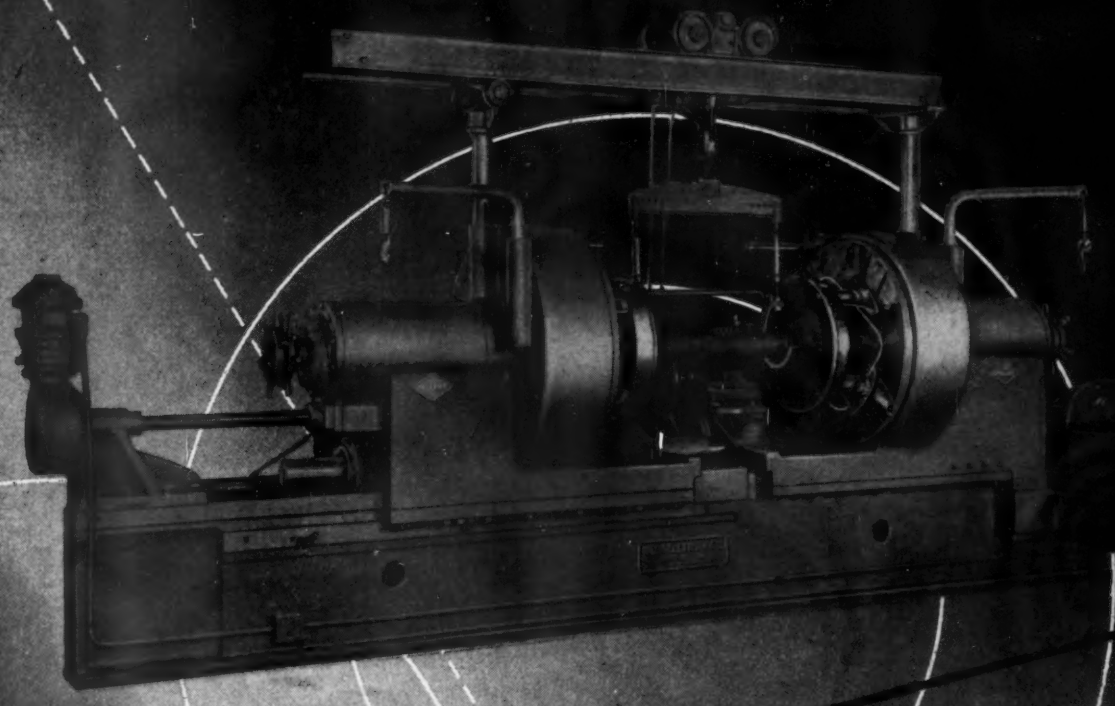

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Hydraulic Driving Dogs—four on each face plate—insure equalization of pressure on wheel rims. Easy to maintain—easy to operate—easy to adjust.

THE SELLERS "75"—the result of 75 years of highly specialized experience in railroad lathe design. The rigidity and speed of this machine insures maximum efficiency for today's and future railroad requirements. Face plate speeds are instantly available—without gear changes—for all types of cutting tools, including carbide.

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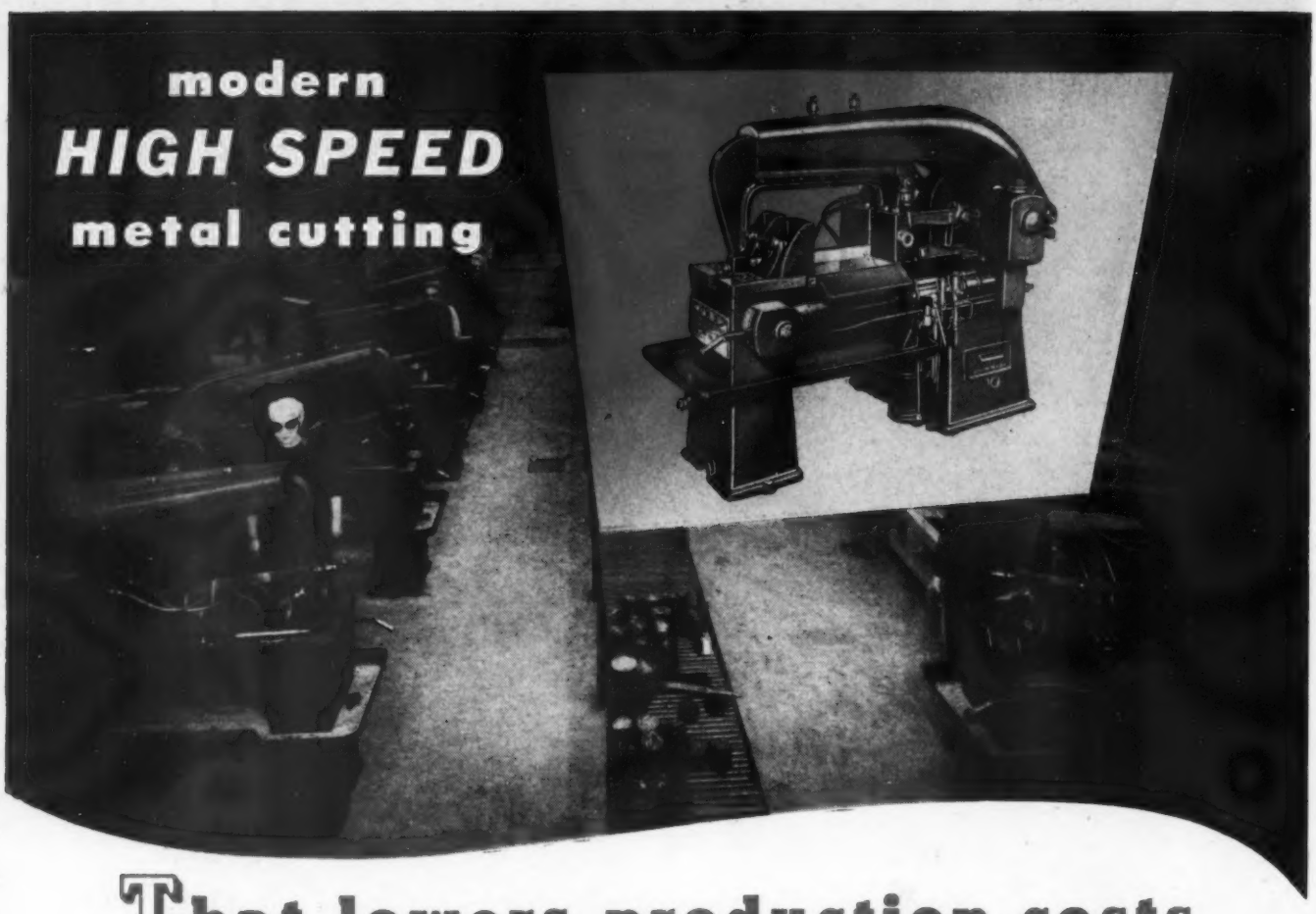

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Here is modern high speed metal cutting—with greatest efficiency —at the start of a great production line. This battery of Racine heavy duty Hydraulic metal cutting Machines in a prominent midwestern steel mill, is speeding up the plant capacity.

These smooth, powerful hydraulic Machines save time and material. Their accuracy reduces the cost of subsequent machining operations—all factors in helping you meet the post war need for maximum efficiency, increased output, lower costs.

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SPECIAL MACHINE FOR FACING AXLE HOUSINGS AT 118 PIECES PER HOUR

There are several distinctive features about this new machine which are typical of Greenlee versatility in building special machinery. *First* is the automatic, power-indexing, three-sided turret with one station for loading two pieces, one working, and one unloading. Two operators handle the machine, one loading and the other unloading the two work pieces. *Second* is the manually controlled, air-operated fixtures for centering and clamping the work pieces. These pieces are "twisty", and are difficult to line up and hold accurately except by a carefully planned fixture arrangement of this kind. *Third* is the tooling, which employs both roughing and finishing tools working simultaneously. There are two spindles carrying cat-heads which are mounted on a single hydraulically operated feed unit. The tool bits are cross fed, with the finishing bit following the roughing bit. The production on this machine (118 pieces per hour at 80% efficiency) is typical of the results that are being obtained with Greenlee machines especially designed and built to meet production requirements and cut costs.

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MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

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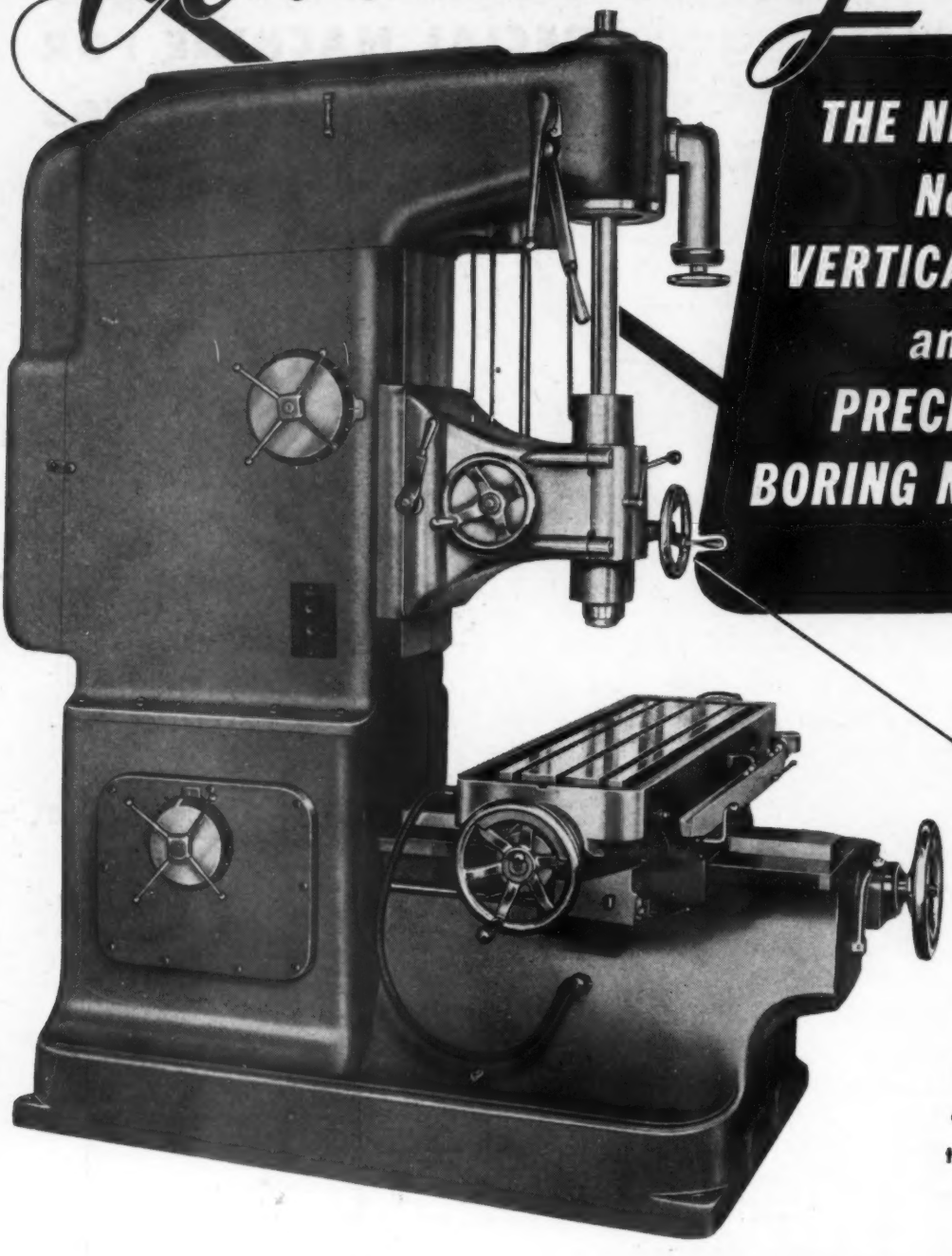

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Combining all the advantages of both a solid base precision boring machine and a powerful, rigid vertical milling machine — unusual capacity, simple in operation, exceptionally adaptable to a wide variety of work.

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NO THOUGHT REQUIRED

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Use gage blocks for set-ups

ALL PRODUCTION PLANTS NEED THIS UNIT

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Twice as fast as human hands, this tireless robot—the DoALL inspection machine—inspects, sorts and counts small parts on production lines. It makes no mistakes, tells you if parts are "over," "under" or "within limits," and what's more, puts the parts in the right pan with amazing speed of 3,000 to 7,000 per hour. Slashes inspection costs one half. Versatile in infinite combinations. Set-up changes for size made in a few minutes. Tolerances adjustable from .0001" to .030".

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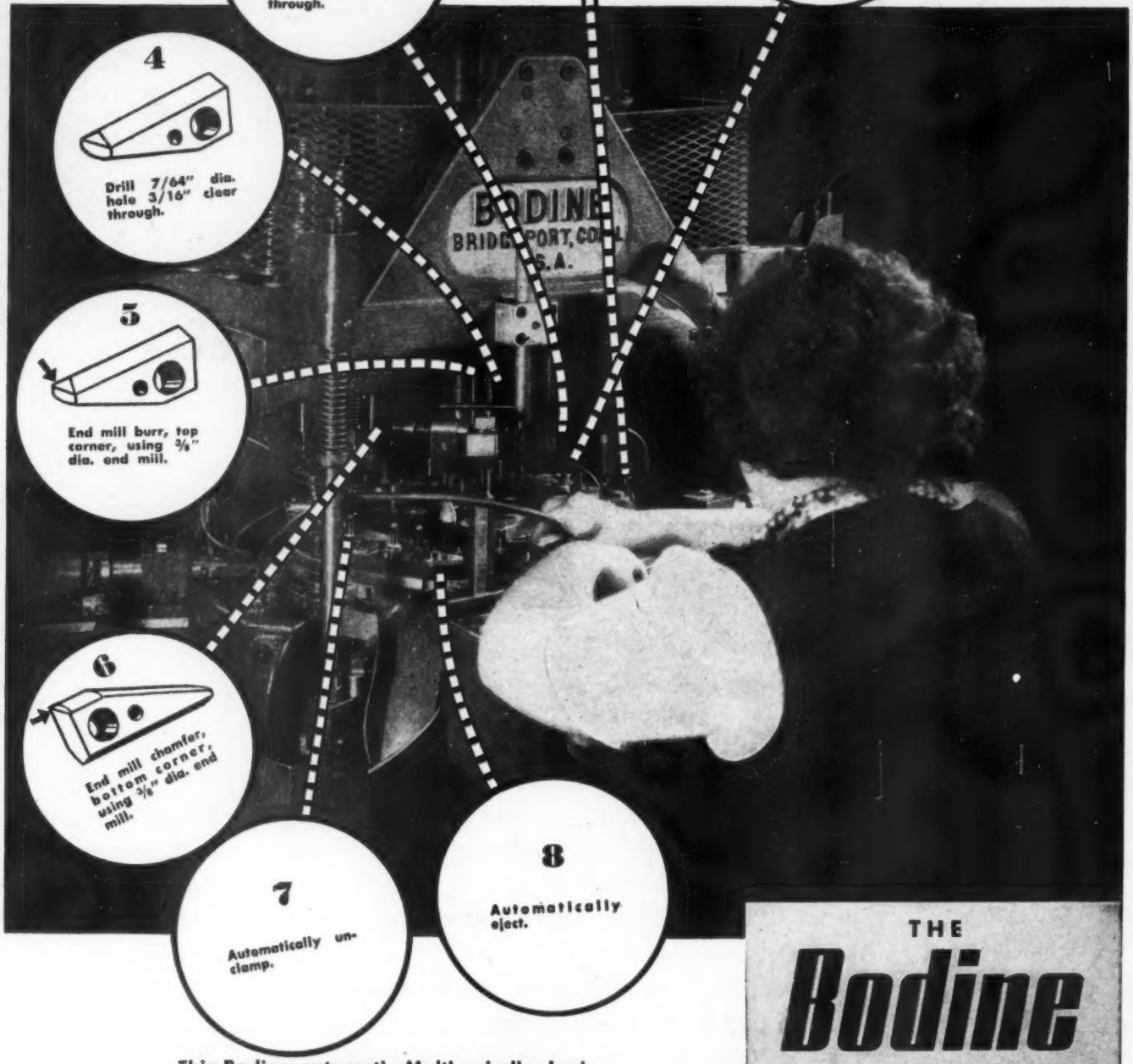
Bodine...Case History No. 15

Producing a Steel Chuck Jaw....

ACTUAL SIZE



This Bodine automatic Multi-spindle, horizontal dial machine is producing 550 pieces per 50 min. hour at one piece per stroke of the machine at the Jacobs Mfg. Co., Hartford, Conn. It can do a similar job for you.

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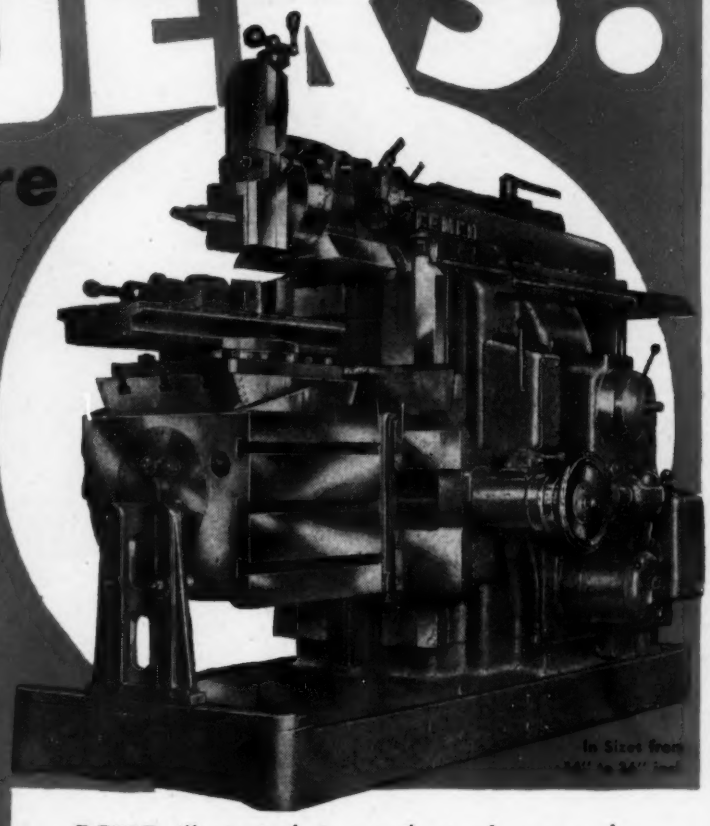

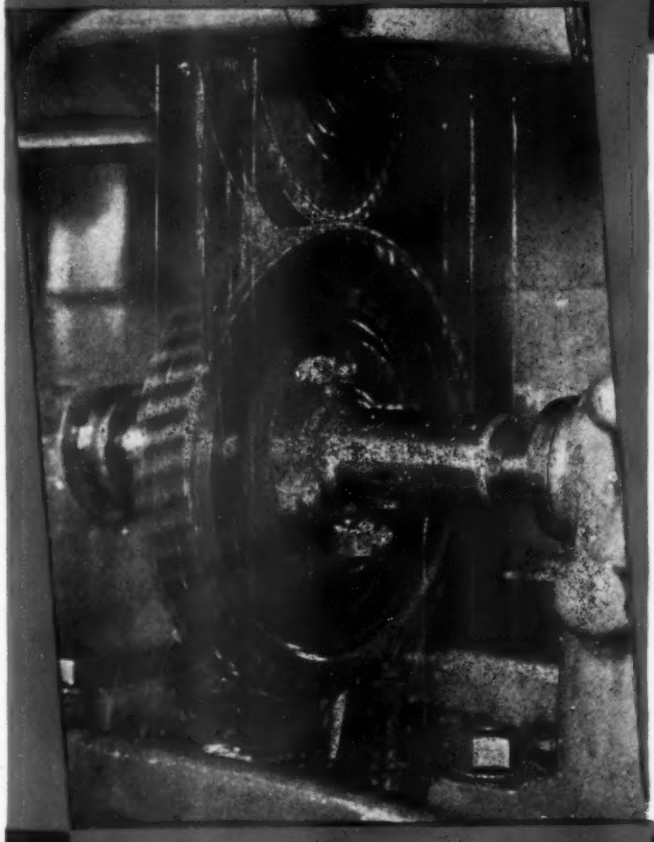

HERE illustrated is another of many dependable and efficient machine tools that contribute to the high degree of accuracy and easy, quiet, smooth running operation so characteristic of GEMCO Shapers.

All GEMCO transmission gears are, after cutting, shaved in order to assure smoothness and quietness when in operation.

Longer satisfactory service life is assured since the precision finish of the gears eliminates undue wear.

In addition, GEMCO Shapers offer many other time tested features: Force-feed lubrication system with exclusive "Lubrigard" safety protection, twin-type bull or main gears, centralized controls, large, easily readable dials, wide range of feeds and speeds—all of which either increase the precision life, save time, or increase production.

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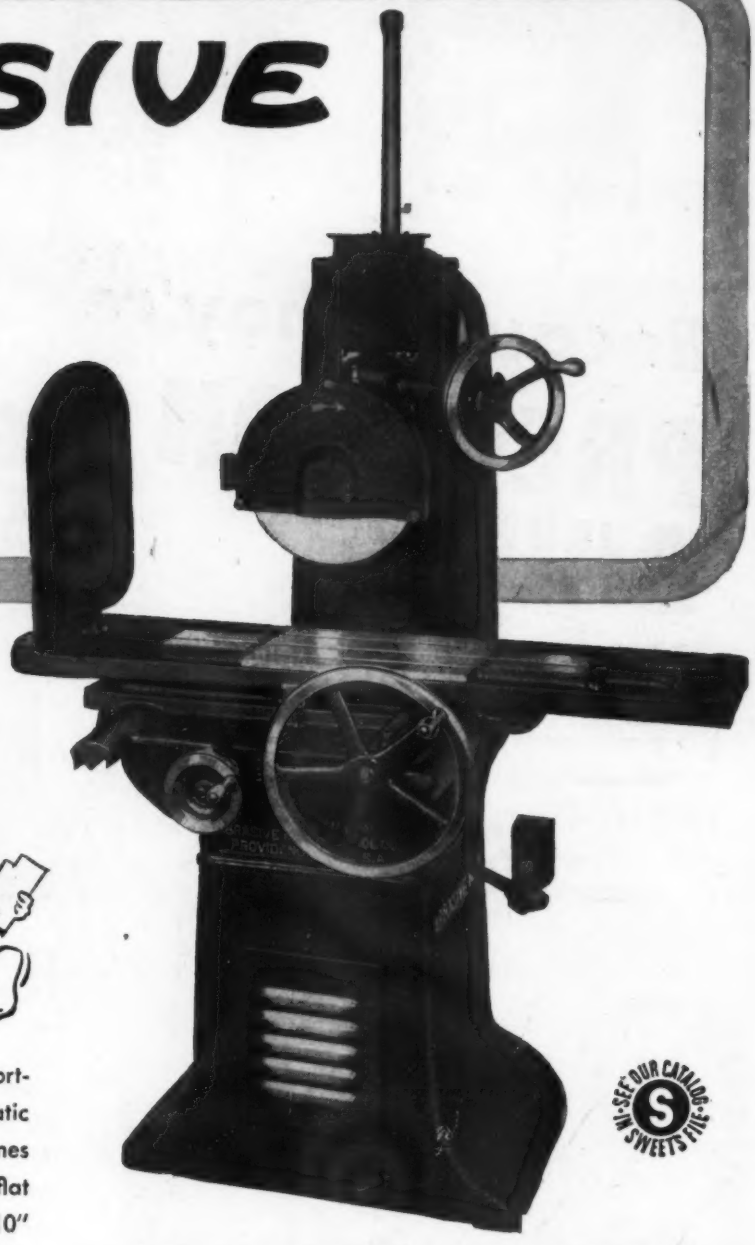
ABRASIVE

No. 1½
HAND FEED SURFACE GRINDER



The ABRASIVE No. 1½ *completes* the average short-run job before it could even be set up on an automatic machine — and it frees the more expensive machines for production runs. Unsurpassed for grinding dies, flat work and gauges, the No. 1½ grinds jobs up to 10" wide with high accuracy and an excellent finish. Its handwheels are large and conveniently located to make operation easy. There are no sprockets, chains or belting . . . the wheel head with integral motor minimizes vibration and distributes weight evenly on both sides of the guide ways. In every respect this hand feed surface grinder maintains ABRASIVE's high standards of engineering and performance.

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SEE OUR CATALOG IN SWEETS FILE

SPECIFICATIONS

WORK CAPACITY—15" long, 10" wide, 12" high

GRINDING WHEEL—Standard 12" diameter

DRIVE—1 H.P. motor mounted on spindle

TABLE SIZE OVERALL—48" x 11¼"

FEEDS—All hand feeds; Transverse graduated .001"; Vertical .00025". Metric graduations if specified

NET WEIGHT—1350 lbs.

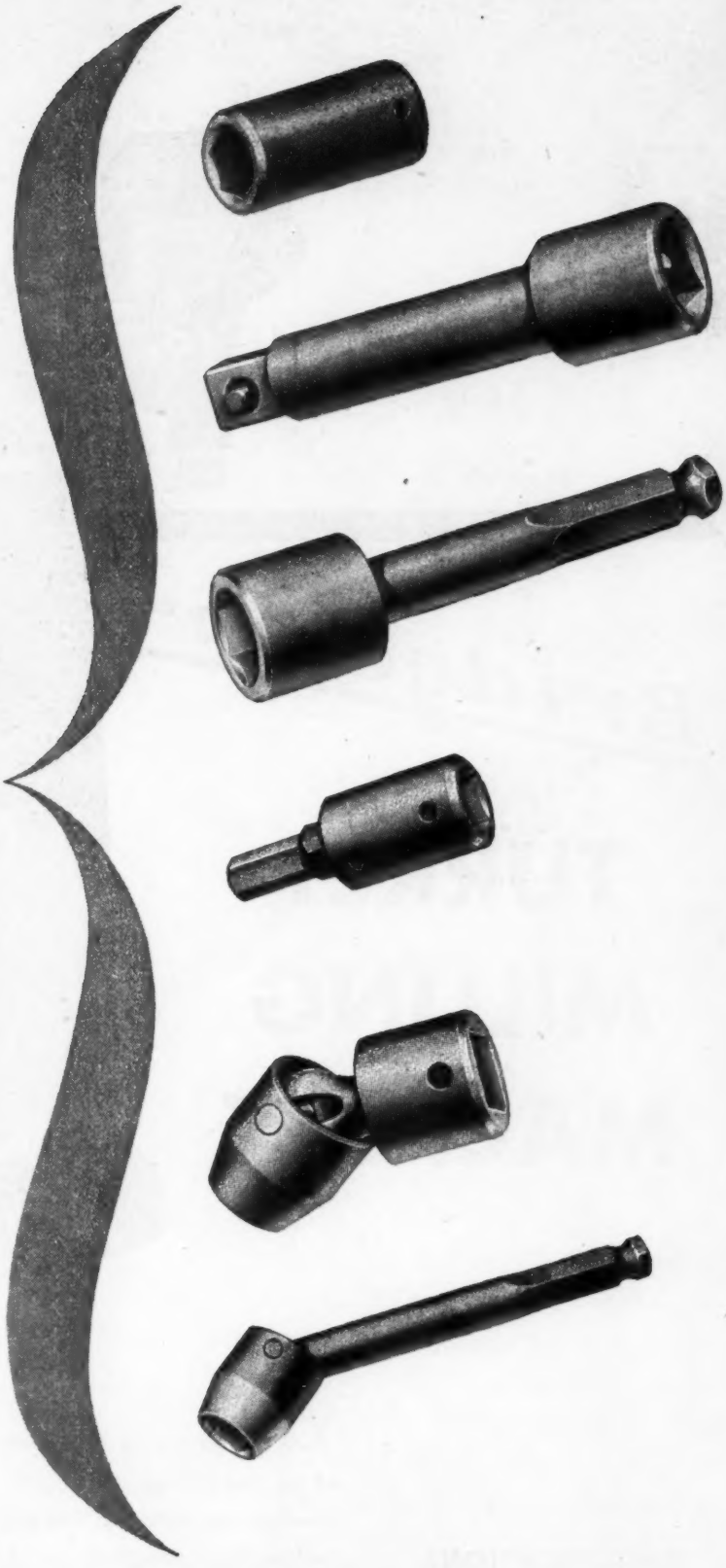
ABRASIVE
ACCURACY BOOSTS PRODUCTION

If you desire information on any Abrasive machine on the Government Surplus Tool List just send us the serial number of the machine: we will endeavor to supply attachments or repair parts as ordered.

ABRASIVE MACHINE TOOL CO.
EAST PROVIDENCE 14, RHODE ISLAND

Cut tool costs

with APEX sockets and wrenches



You drive down your tool cost when you standardize on Apex sockets and wrenches. *Reason one:* Apex production sockets are accurately machined from electric-furnace high-carbon alloy bars — cold broached and carefully heat-treated for maximum strength, wear, and shock resistance. *Reason two:* these sockets and wrenches can be furnished—on request—to definite hardness specifications, for top service on specific jobs. *Reason three:* Apex sockets stay on the toughest jobs (driving self-tapping screws, for example) as much as three times longer than ordinary sockets.

Select from thousands of standard items—or if you need specials, send a sketch, print, or description, and we'll quote promptly. Write for Catalog 18.

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APEX SOCKETS

Safety Friction Tapping Chucks; Quick Change and Positive Drive Drill Chucks; Vertical Float Tapping Chucks; Parallel Floating Tool Holders; Power Bits for Phillips, Slotted Head and Clutch Head Screws; Hand Drivers for Phillips and Clutch Head Screws; Aircraft and Industrial Universal Joints; Sockets and Universal Joint Socket Wrenches.

Bridgeport

TURRET MILLING MACHINE

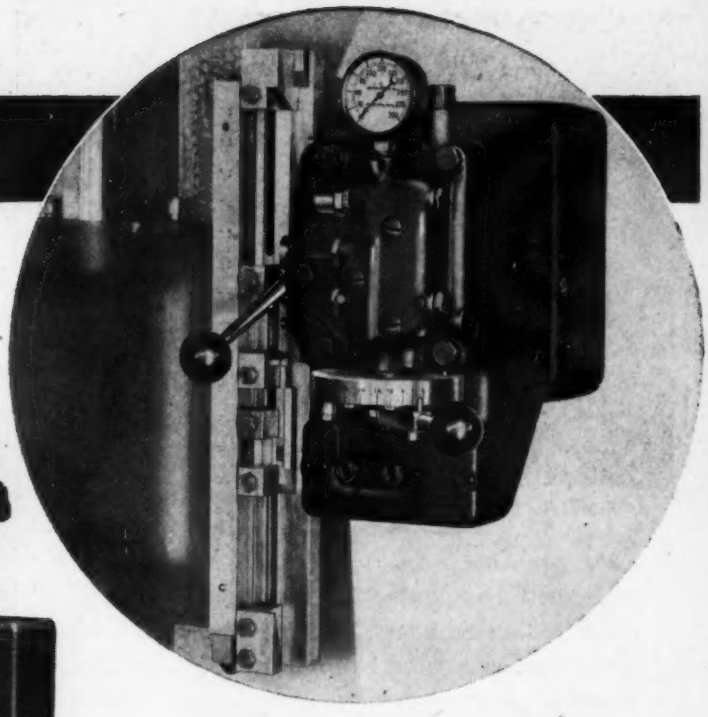
SPECIFICATIONS

Longitudinal Feed—20"
Cross Feed—9"
Vertical Feed of Knee—16"
Standard Table—9" x 32"
Special Tables up to 48" available; also longitudinal power feed
Weight with Shaping Unit—2000 lbs.

YOU can go a long way toward offsetting high production costs by taking advantage of the time savings possible with the Bridgeport Turret Milling Machine. Here in a single machine are combined not only the ability to mill, drill, bore and shape but also to handle these operations *at all angles with a single set-up*. Greater accuracy on all operations is also assured. If you are not already using a "Bridgeport" you may be overlooking many real opportunities to cut costs and step up poduction.

Full details about this versatile machine are available on request.

BRIDGEPORT MACHINES, INC., BRIDGEPORT, CONN.



THE LELAND-GIFFORD No. 4 HYDRAULIC DRILLING MACHINE . . . . . .

A RUGGED GIANT *For Speedy Drilling*

Features

Feed Control- By displacing oil on back pressure side of piston.

Rapid Approach and return at rate of 240" per minute with cutting feeds from ½ to 20" per minute.

Ability to Jump Gaps.

Spot Facing by feeding against an adjustable positive stop, thus maintaining extreme accuracy.

Overload Pressure Release prevents injury to drill or work.

Step by Step Drilling For deep holes.

Send for Bulletin No. 800

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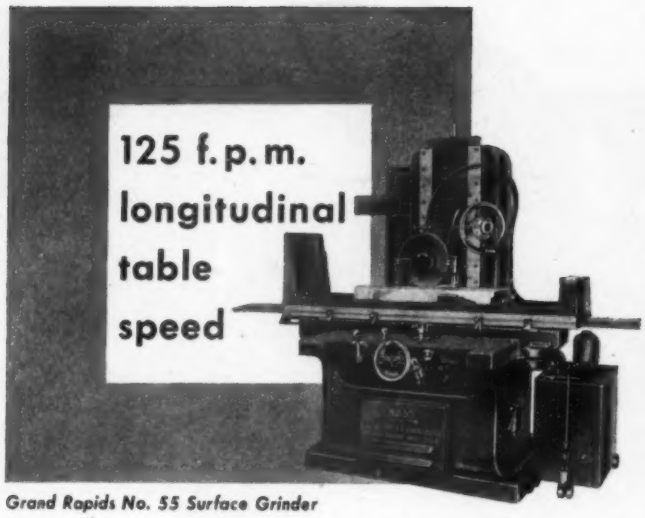


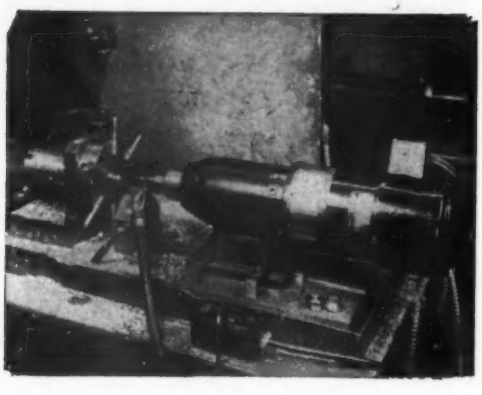
Grand Rapids No. 55 Surface Grinder

Faster precision production is possible with the exceptional table speed of Grand Rapids Hydraulic Feed Surface Grinders. Both longitudinal table travel and cross feed are automatic, hydraulic. Wheel head is powered for rapid vertical travel.

Write for Bulletin GL-101

GALLMEYER & LIVINGSTON COMPANY
Manufacturers of Grand Rapids Grinders
330 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.

1200 HOLES DRILLED PER HOUR --WITH A SINGLE SPINDLE



The New Model "K" Automatic Drilling Unit, installed on a hand-indexing fixture at McLaren Screw Products, Detroit, is achieving the phenomenal production rate of 1200 holes per hour, using a 13/64" diameter drill with a 30° included angle on point.

If you would like to step up your own production rate in drilling holes up to ⅜" diameter, send blueprint or part for our recommendation. No obligation.

WRITE FOR Literature

GOVRO-NELSON CO.
1933 Antoinette
DETROIT 8, MICH.

Automatic **DRILLING UNIT**

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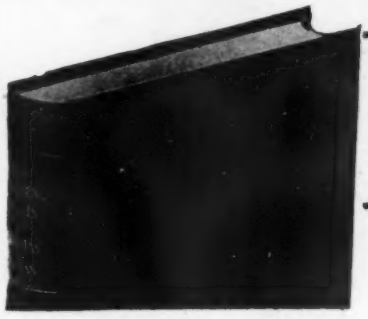
3 *important* books on TOOL DESIGN

written for you by an expert



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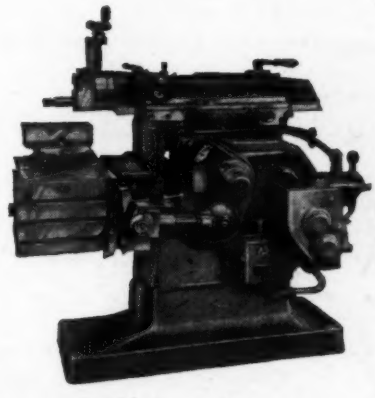

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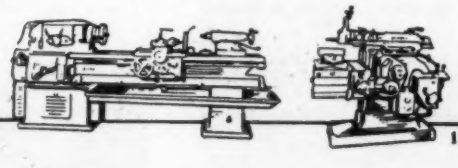
TOOL ROOM LATHES
12"-16"-18"



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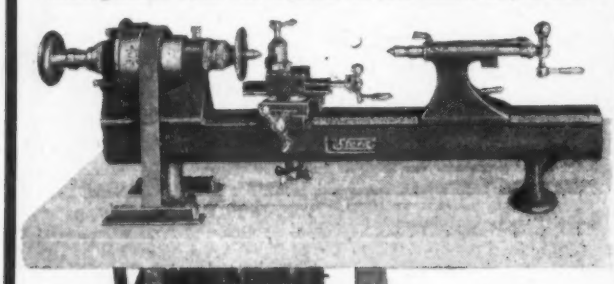
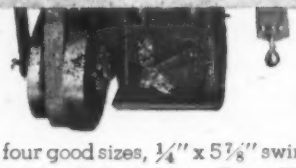
Built-in infinitely adjustable drive with any speed at the turn of a convenient handwheel in front. No special bench or cabinet required. 156 to 2200 r.p.m. with Standard (toolroom) model and 220 to 3500 with High Speed (Manufacturing) model. Smooth brake and clutch. Capacity, ¾" or 1" through headstock; 9" swing, 40" length bed.

30 PRECISION ATTACHMENTS correctly designed for the very best facility and accuracy are interchangeable with all Starks of the same lathe size





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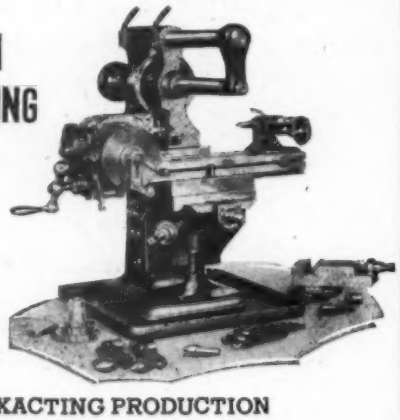
Built in four good sizes, ¼" x 5⅞" swing, ½" x 7", ¾" x 9" and 1" x 9" with Stark Motor Drive Unit, the first compact, smooth under-bench drive, with 9 speeds—the full working range.

PRECISION BENCH MILLING MACHINES

Plain and spiral Models, motor-driven. Table 18" x 4", feed 10", transverse 3½", vertical over vise 4¾".



FOR EXACTING PRODUCTION it is fitted with fast lever feeds

Also "ELECTROBLAST" Muffle Furnaces

Gas fired. High speed steel temperatures in 20 minutes. Built in two small sizes.

FOR FURTHER INFORMATION, WRITE US.

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WALTHAM · MASSACHUSETTS

ESTABLISHED · 1862

Originators of the American Bench Lathe

Increase your production!

200 PIECES PER HOUR WITH THIS *Bradford* SEMI-AUTOMATIC DRILLING MACHINE

Bradford semi-automatic two-unit four spindle drilling machine equipped with 24" diameter two-station manually operated index. Control of machine fully electric.

Drills two 23/64" and two 1/4" holes in transmission extension at the rate of 200 pieces per hour.

This Bradford machine is a thrifty way to increased production.

Write for Bulletin 500

The BRADFORD MACHINE TOOL CO.

1840 - 1946 CINCINNATI, OHIO

BEFORE YOU BUY A TAPPING MACHINE

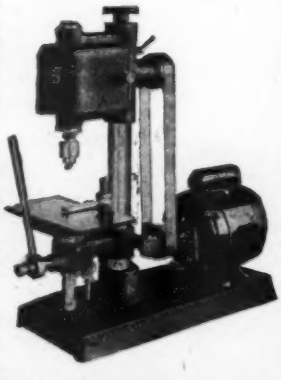
Let's Talk About Tapping!

You've had your troubles with poorly designed tappers, as have we all! Tap breakage; want of adaptability; wrong spindle speeds; limited capacity, and a long procession of wanted features that are **needed** in a tapper if it is to earn its keep.

But have you tried the Hamilton Sensitive Tapping Machine? Here is a machine that literally *feels* its way into the hole while the spindle idles in reverse. A machine that taps to the very bottom of blind holes, reverses direction of rotation and withdraws the tap automatically and *without tap breakage.*

Designed for small hole tapping (from the smallest and finest tap to 10-32 inclusive) it has ample travel and clearances and proper power and speed characteristics for intensive production. And more! It's sensitive and versatile. An ideal tool for the tool room.

Let's talk some more about the matter. Write for descriptive literature and ask us some questions . . . we love 'em. Address Department D-T.



THE *Hamilton* TOOL COMPANY

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Save Time

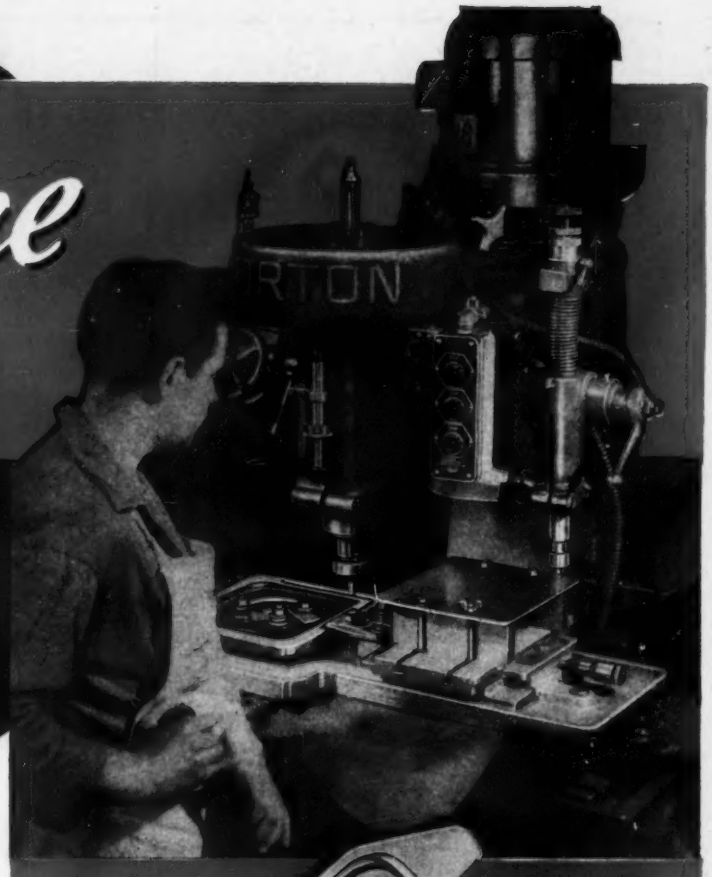
ON SHORT RUN MILLING OPERATIONS

by tooling your work on a

GORTON

with

Tracer Control



TRACER CONTROLLED MILLING IS ... SIMPLE ... FAST ... ACCURATE

This illustration shows just one of many applications of tracer control as applied to milling. Gorton tracer controlled equipment includes Duplicators, Pantographs and Electric Arc Etchers for milling, engraving, etching and many other metal removal operations.

Simplicity of operation, high spindle speeds and precision are built-in Gorton characteristics which enjoy enthusiastic approval among thousands of Gorton users throughout the world. It will pay you to investigate Gorton Tracer Control now.

GORTON PRE-DETERMINES RESULTS for YOU

Send us complete description with prints of one of your jobs. Our Engineering Department will send you a production estimate on the same job tooled on Gorton tracer controlled equipment—no obligation.

JOB FACTS

1. NAME OF PART—*Packaging Machine Cover*
2. MATERIAL—*Cast Iron*
3. MACHINE—*Gorton 9-J Duplicator*
4. OPERATION—*Mill Gasket Groove—10 in lot*
5. ACTUAL CUTTING TIME—*4½ Minutes each*
6. CUTTING TOOLS—*Gorton End Mill—10 Pieces per Sharpening*

WRITE TODAY FOR THIS BOOKLET

Bulletin No. 1655 will give you complete information on all Gorton tracer controlled machines . . . what they are . . . what they do . . . how they operate. It's yours for the asking.

GEORGE GORTON MACHINE CO.

TRACER CONTROLLED MILLING

1511 RACINE STREET • RACINE, WISCONSIN

NESTED MATERIAL IS SECURELY HELD UNDER HEAVY CUTS ON THE

PORTER-McLEOD COLD METAL SAWING MACHINE

Ability to cut stock from 3 inches up, to nest and hold bars or shapes securely for multiple cutting, combined with a standard feed of 3" per minute enable this modern, sturdy, clean-lined machine to make big savings in cutting-off time. A wide range of work can be handled by the 8" Porter-McLeod because of its capacity for 8" round or 7½" square stock. All cuts are accurately and cleanly made at highest speeds.

Truly high production is assured by unique features of design coupled with ample power. The blade is pulled upward through the stock, the blade being supported in such a way as to prevent buckling or weaving. Protection of the blade against hard spots in the stock being cut is provided by a friction disc feed. The Porter-McLeod blades are designed so that every tooth cuts, a feature which contributes to the remarkably fast cutting assured by this machine.

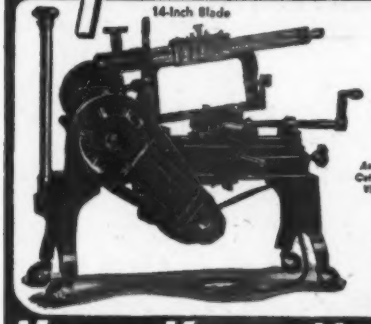
If you are interested in reducing time on cutting-off operations, get all details at once. Anyway, write for Descriptive Bulletin.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U.S.A.

MACHINE TOOL COMPANY

POWER HACK SAW ★

14-Inch Blade



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PORTABLE
STURDY
Angle Cutting Vise
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ECONOMICAL
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MILLER-KNUTH MFG. CO. OMAHA, NEB.

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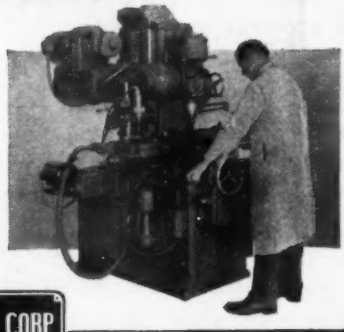
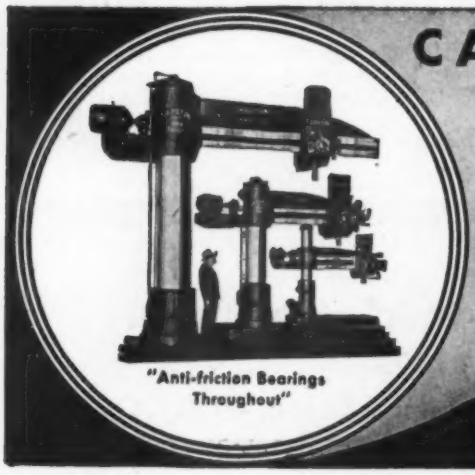


REED-PRENTICE CORP.
WORCESTER MACHINE TOOLS MASS U.S.A.

CARLTON RADIAL DRILL



"Anti-friction Bearings Throughout"

FEATURES— 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

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MACHINE TOOL COMPANY
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Advantages of Famed Swiss Precision for American Production

IF you are working to tolerances of "quarter tenths" on a production basis, Swiss high precision machine tools and measuring instruments will give you the unusual advantages of highest accuracy, convenience of operation, ease of control and exceptional versatility — factors that spell new proficiency and new economy on even the most exacting jobs.

All these advantages of famed Swiss precision are obtainable through the Cosa Corporation, headquarters for the following Swiss Machine Tools and Measuring Instruments: SIP Jig Borers, including the Hydroptic-B Jig Boring and Milling Machine, with its built-in optical measuring system . . . SIP Profile Projectors, Dividing Machines and Measuring Instruments . . . Studer Profile Grinders . . . Bechler Automatic Lathes and Screw Machines . . . Mikron Gear Hobbing Equipment . . . Safag Automatic Pinion and Wheel Cutting Machines . . . Sallaz Burnishing Equipment . . . Schaublin Turret and Finishing Bench Lathes . . . Lienhard Pantographs, 3-dimensional Copying and Milling Machine.

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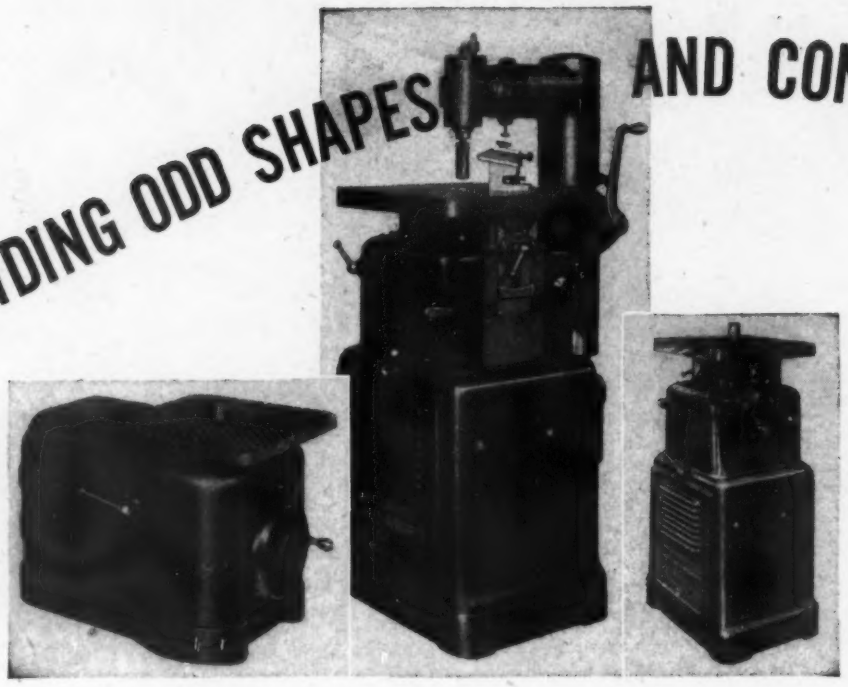

No. 1
PROFILE GRINDER

A bench size tool operating at 20,000 R.P.M. with vertical oscillations. For oscillations. For grinding die clearances, sharpening punches and economically finishing cams and templates.

In production grinding too, this Grinder has proved a valuable tool.

Boyar-Schultz Grinders are designed and built for grinding and finishing irregularly curved surfaces and contours so frequently encountered in the tool room and die shop. Dies and punches, templates, cams and special parts are finished with time-saving speed.

No. 2
PROFILE GRINDER

Dual Spindle Model. Larger floor model with two independently powered spindles, operating with vertical oscillations at 10,000 R.P.M.

A rapid stock remover even with small diameter wheels.

Single Spindle Model with lower spindle only. A tool that has demonstrated its value in the tool and die shop.

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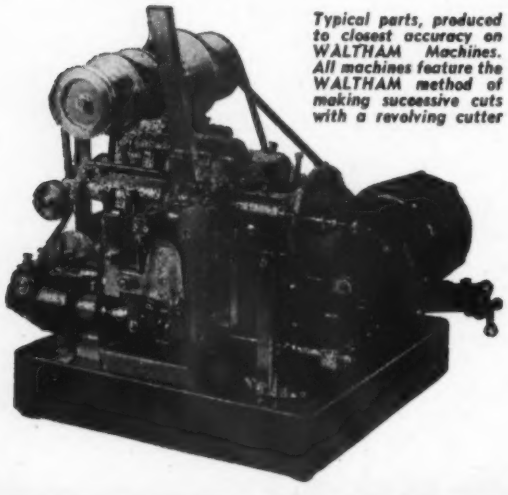
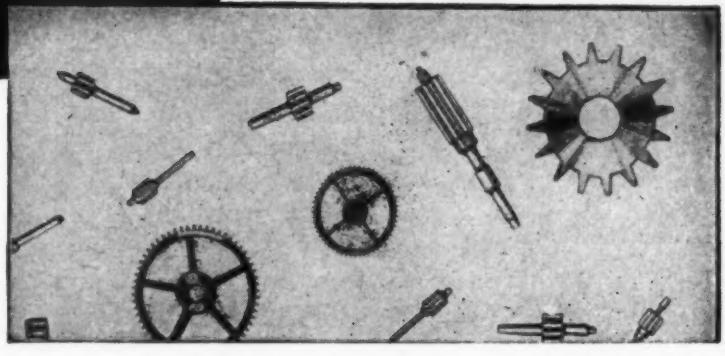
WALTHAM
PINION & GEAR CUTTING MACHINES

for precision production of fine pitch mechanisms



Typical parts, produced to closest accuracy on WALTHAM Machines. All machines feature the WALTHAM method of making successive cuts with a revolving cutter



Single-Cut Pinion Machines This machine employs one cutter. Blank is positioned and machine started by hand, all other movements being automatic.

Multiple-Cut Pinion Machines Two or three cutters on arbor of cutter spindle make successive cuts. Machine stops on completion of last cut.

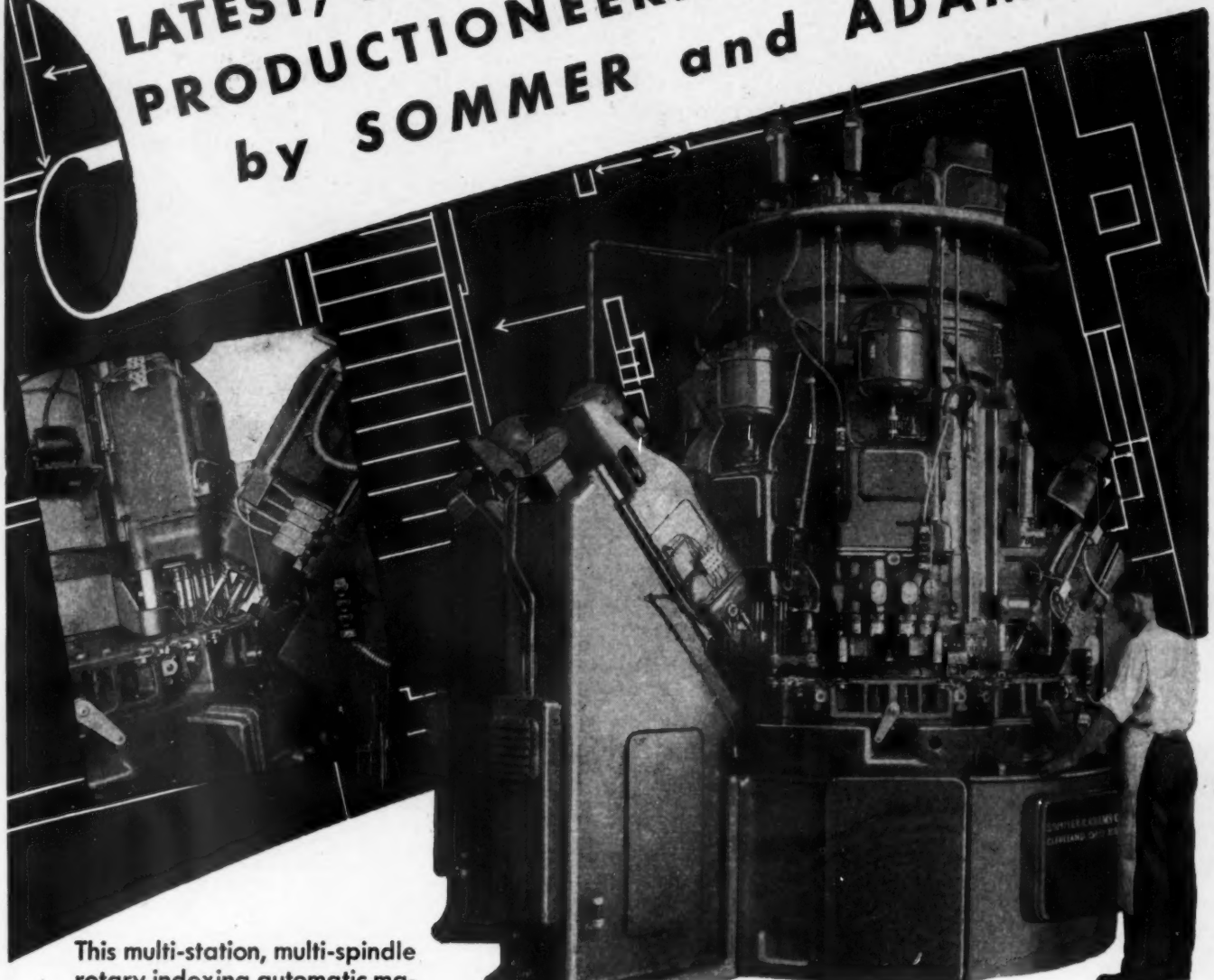
Magazine-Fed Pinion Machines Provides continuous production of one kind of pinion. Magazine is loaded and all other operations including cutting and ejecting are automatic and continuous.

Gear Cutting Machines Single and Multiple cut machines equipped with special cutter swing provide the means of cutting teeth on gears up to 1½" pitch diameter and in a stack ¾" to 1" long.

Write for literature giving detailed specifications

WALTHAM MACHINE WORKS
WALTHAM, MASS.

LATEST, BUT NOT LAST, PRODUCTIONEERING UNIT by SOMMER and ADAMS



This multi-station, multi-spindle rotary indexing automatic machine is a typical example of Sommer and Adams Productioneering. It is designed to bore, ream, counterbore, chamfer, tap and face a number of holes in small motor blocks, pump parts or machine components.

On the machine itself, any sequence of operations up to eight stations can be set up, each operating head having its own electric motor and hydraulic system, electronically synchronized with the rest, and with the indexing mechanism. These heads operate vertically. Further operations at desired angles may be added at any or all of the stations, with separate column-mounted heads having the same type of independent mechanism, which can be synchronized to the machine cycle. (Inset shows close-up of vertical and angle operations at the same station.) . . . Your problem may be different—but if it can be solved mechanically, Sommer and Adams can build machines to do it.

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SUBSIDIARY OF THE FEDERAL MACHINE AND WELDER COMPANY

2, 3 & 4 SPINDLE

Popular standard adjustables for holes equally spaced on varying circles. Three-spindle heads available for holes equally spaced in a straight line. Recommendations for standard or special drillheads made promptly and without obligation.

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Adjustable Drillheads

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when you want power-

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Strand Flexible Shaft machines provide constant speeds with greater operator convenience. Hundreds of attachments easily interchanged—125 types and sizes—models include vertical and horizontal type machines from ⅛ to 3 h.p. Distributors in all principal cities.

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INCREASE PRODUCTION IMPROVE QUALITY USE ANTON PARALLELS

ANTON PARALLELS FILL A LONG-FELT NEED—Permanently straight and accurate, yet priced for general machine shop use. All parallels fully guaranteed to be within the limits specified. Maximum size tolerance .001 inch on ground sides. Maximum variation in parallelism and straightness within length, .0001. Rockwell "C" hardness 65 up.

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Price per set includes a handy Wooden Container. Large Stock of Single Pairs also Available. All Prices are F.O.B. New York

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No. 80 Wire Gauge to 1 Inch

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"TYCOL DUAL PURPOSE OIL jumped production 25%"

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These statements, made by leading manufacturers are paralleled wherever Tycol Dual Purpose Oils are used. You, too, will find that *one* versatile oil not only does the work of two separate oils, but it steps up production . . . slashes costs . . . reduces cutting time . . . provides better finishes.

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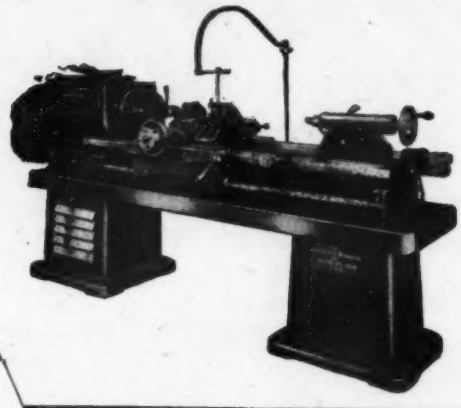
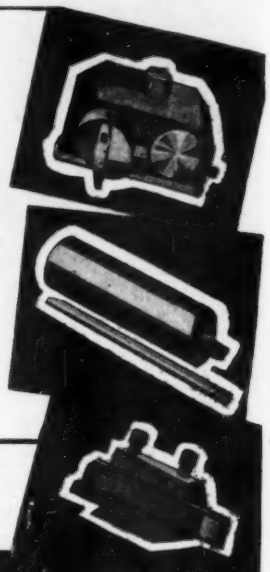
The many different and number of threading tools which can be arranged on the tool slides both front and rear, make this machine the most versatile of any for production of square, standard, and 29 degree threads, both internal and external

Equipped with disc clutch. . . . Easy to operate . Rigid Construction. . . . Four speed headstock. . . . Return or Idle travel speed has been increased five times cutting speed.





PRODUCTION MACHINES SINCE 1896

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The James COULTER *Machine Co.*

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The RUGGED-TROUBLE-FREE DI-SAW

Product of more than 50 years of specialization in the manufacture of band sawing machinery the TANNEWITZ 24M is the machine that will enable you to capitalize to the fullest extent on the economies of contour sawing, inside and outside filing and polishing. It's rugged, with every detail of construction thoroughly proved, — TROUBLE-FREE. And it carries full 24-inch wheels which make for easier, straighter sawing. For complete details write for DI-SAW Bulletin.

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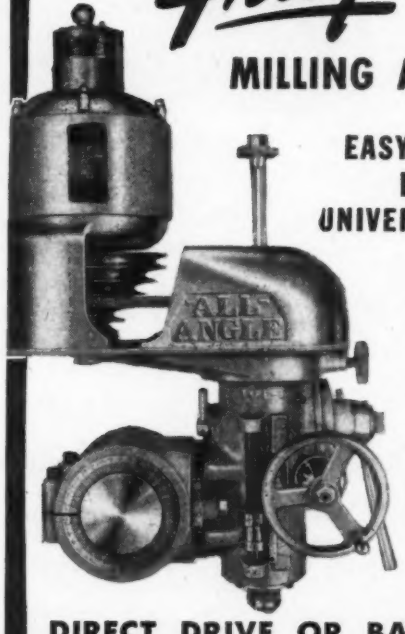

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It is an all purpose attachment which has thoroughly proved itself all over the world. Ideal for the making of plastic molds, die casting molds, permanent mold casting molds, metal patterns, tool and die making, production work of all kinds, as well as for grinding, drilling, boring, etc.

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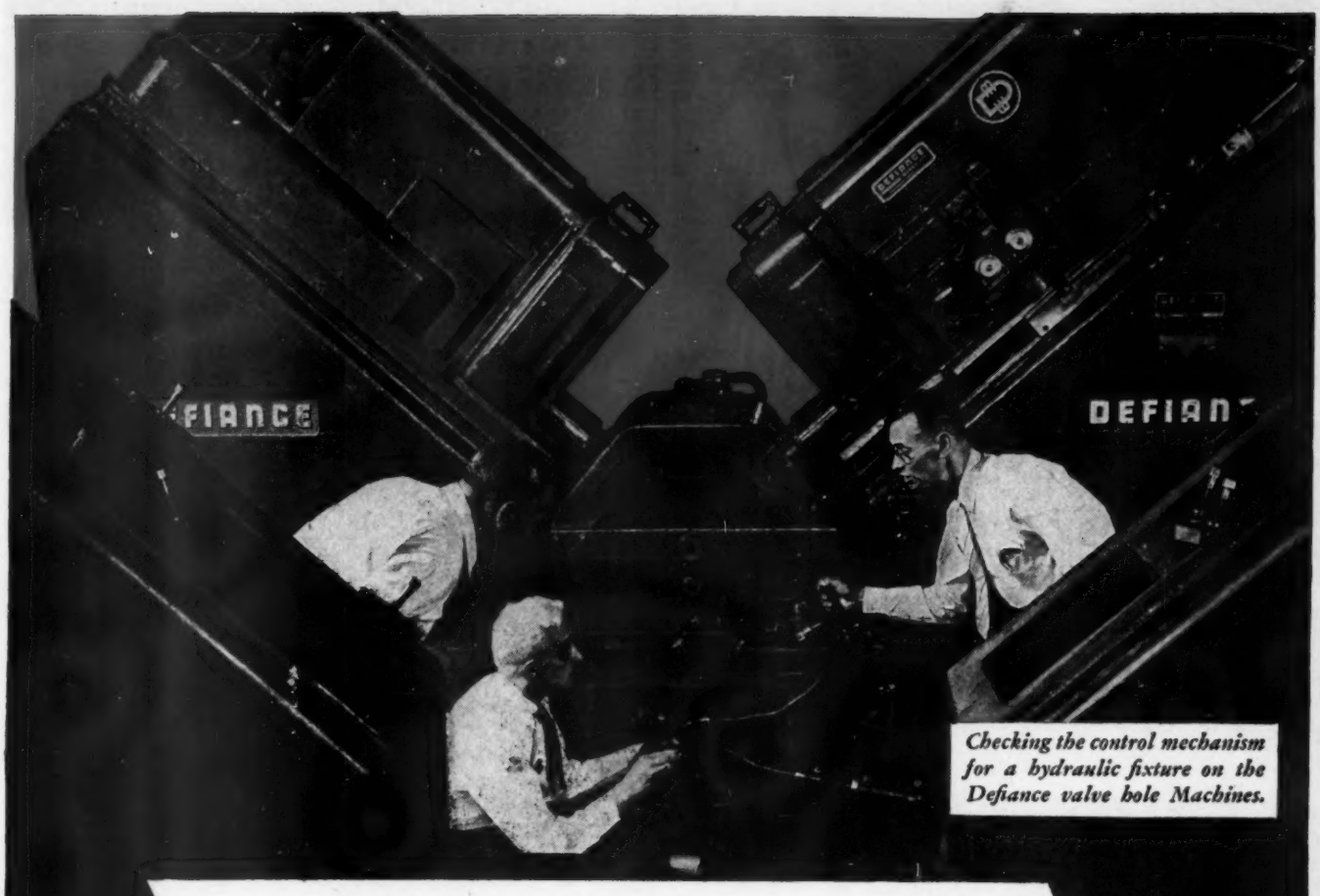

Checking the control mechanism for a hydraulic fixture on the Defiance valve hole Machines.

PRECISION

. . . IN PRODUCTION MACHINING ON V-TYPE MOTORS

Eight of these Defiance Machines in a series handle machining of valve holes and inserts in the manufacture of V-type motors. A job demanding *accuracy* in a difficult set-up!

The machines are No. 37 hydraulic units . . . mounted in pairs on columns at proper angle . . . tunnel type fixture with locating pins and clamping arrangement hydraulically operated and automatic. The first machine in the series has 8 spindles — the others, 16 spindles each. Sequence of operations is as follows: machine valve chambers and rough cut the counterbore for inserts . . . rough bore tappet holes and valve guide hole . . . semi-finish valve guide and tappet holes . . . machine valve clearance and semi-finish insert counterbore diameter . . . fly cut valve guide and tappet holes . . . line ream insert counterbore, valve guide and tappet holes . . . rough cut valve seats of inserts . . . finish cut seats of inserts.

Whatever your problem in boring — milling — drilling . . . consult with Defiance. Get *precision and efficiency* to improve quality and cut costs! Write . . . Defiance Machine Works, Inc., Defiance, Ohio.

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96 YEARS OF PRECISION MANUFACTURING

IT COSTS MONEY TO GUESS WRONG

. . . a fact that can be especially true when it comes to selecting the raw materials or special machinery — *or reamers* — used in manufacturing your products.

But there's never any need to guess whether the *reamers* you buy can handle the job with the kind of efficiency you want when you specify L & I Ground Flute Reamers. They've *got* to be good because they're made from solid, high-speed bar steel that's uniformly hardened and treated *before the flutes are ground* (not milled). As a result you get reamers with true-line, longer-lasting, keener-cutting edges that are free from burrs and saw-teeth.

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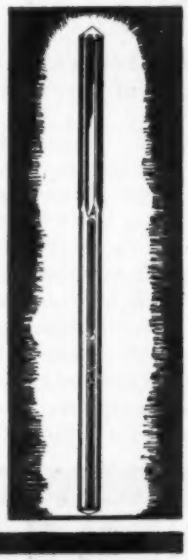

Write today for descriptive catalogs giving prices and sizes. L & I Ground-from-the Solid Reamers are available in any quantity for immediate delivery. Stock sizes from .040″ to .3125″ diameter. Specials in any size.

7

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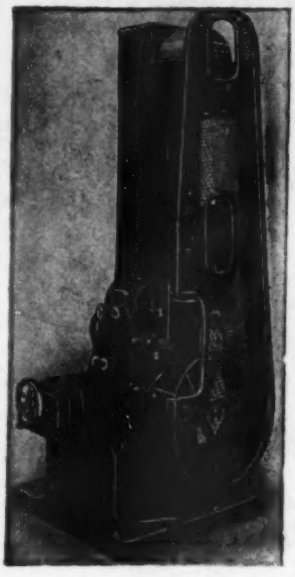
L&I GROUND FLUTE REAMERS

NO CENTERING or CHUCKING on the "PRODUCTION" *Type A High Speed* POLISHING MACHINE



On this high speed machine work can be fed to a stop and finishing limited to that portion of the abrasive belt which is to be finished. Regardless of how used, this machine can be operated by unskilled labor with assured results in speed and high quality finish.

An outstanding advantage of the Type A Centerless Feed Polishing Machines, is the fact that no centering or chucking is required. Work is merely fed automatically by a power feed attachment.

A Taper Feed Attachment is available for this machine for feeding tapered cylindrical work.

Write for illustrated literature giving full information.

Specifications

Capacity (with power feed attachment)—¼″ to 6″ dia. Speed leather cushion belt—6300″ per min. Floor Space—40″ x 50″. Motor—10 H.P.

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They save 50% on sawing, filing and lapping operations, easily maintaining .002″ limits. Ask for special bulletin—also circulars on Drill Grinders, Point Thinners, Tool and Cutter Grinders, Face Mill Grinders and Tool Bit Grinders.

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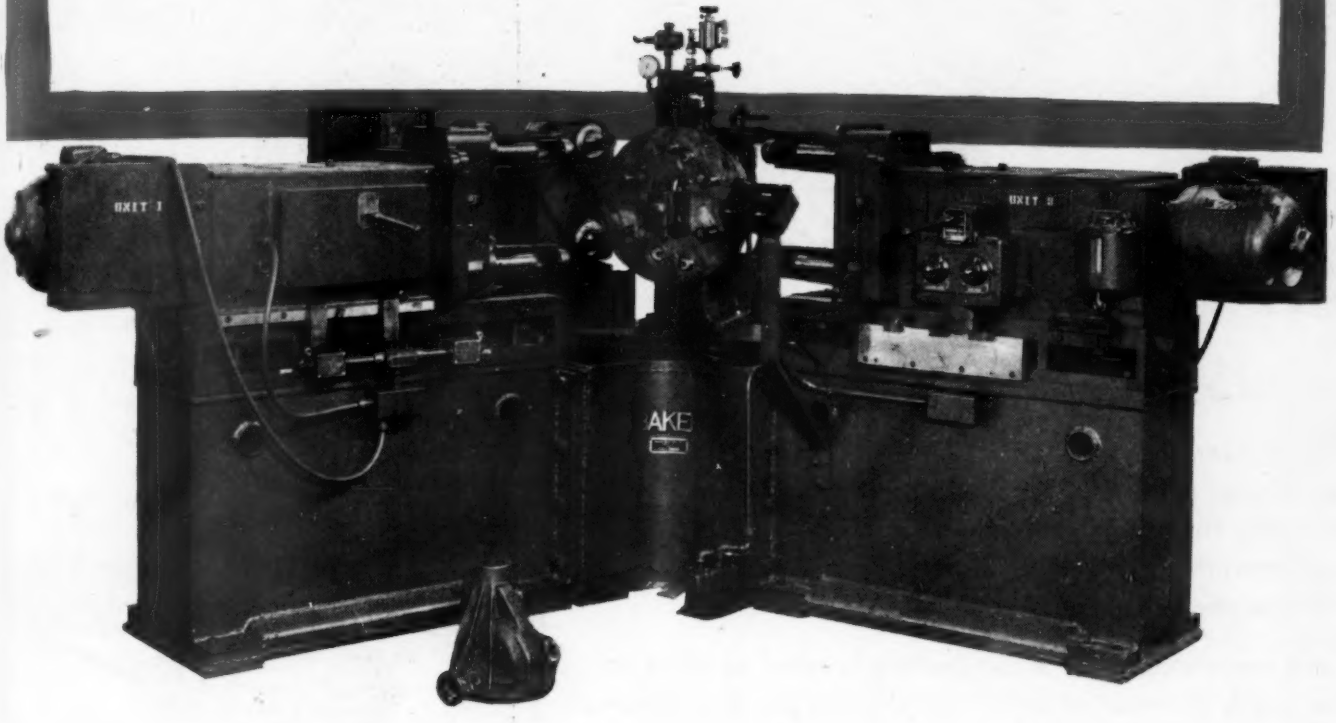
Multiple

OPERATIONS AT ONE CHUCKING BROUGHT HIGHER PRODUCTION AND CUT COST HERE



If your production records and cost sheets reflect too high a unit cost, better check with BAKER . . . because that extra expense is undoubtedly due to lost time and handling cost incurred in step-by-step production. The answer is BAKER Multi-Operation Machines, like the Model 7½ AA 14 shown above. This unit drills 12 weld holes at a time in a malleable iron rear axle differential carrier—operating in three directions simultaneously. Thus the part is finished in one operation rather than three. The unit is flexible, will handle single and multiple spindle operations and can also be quickly retooled for a new set of multiple heads for a complete new operation. Important too, these machines are completely automatic in cycle and offer fast traverse, automatic feed engagement and automatic rapid return.

Write to Baker on your special production problems. Our engineering staff will be glad to recommend methods of handling to speed your production operations and lower costs.

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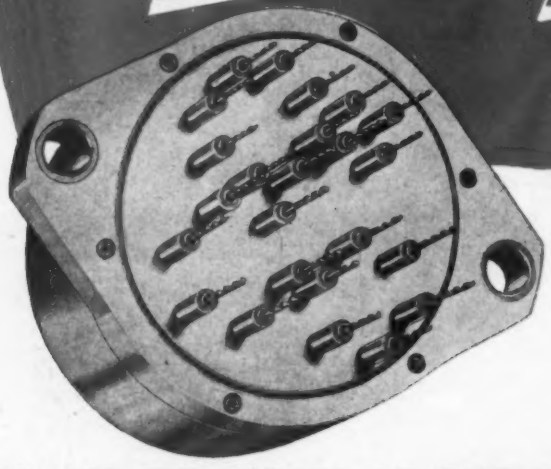

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Zagar Gearless Drillheads solve your multiple drilling problems. Created and developed by Zagar tool engineers. These drillheads enable your plant to produce a better, more uniform product with astounding savings in time and cost.

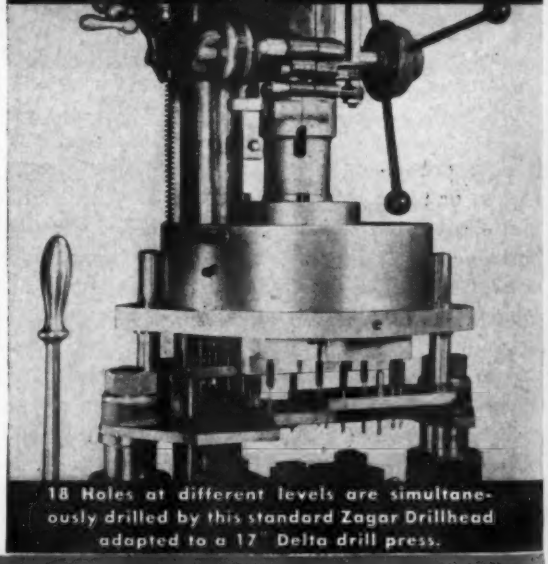
Any number of drills, in any pattern, located as close as twice the diameter of the drill, run at full power... noiselessly and vibration-free...on precision needle, tapered roller and ball bearings.

Standardized Zagar Gearless Drillheads are easily adaptable to your drill presses or can be obtained from us as a complete hydraulic machine.

WRITE FOR CATALOG NO. 811

ZAGAR TOOL, INC. • 23880 LAKELAND BLVD. • CLEVELAND 17, OHIO

This complete Zagar Hydraulic Machine drills 6,600 holes per hour...220 in each gas burner.



18 Holes at different levels are simultaneously drilled by this standard Zagar Drillhead adapted to a 17" Delta drill press.

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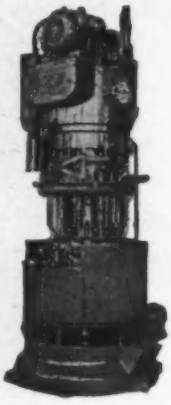

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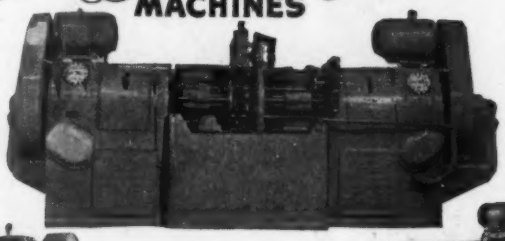

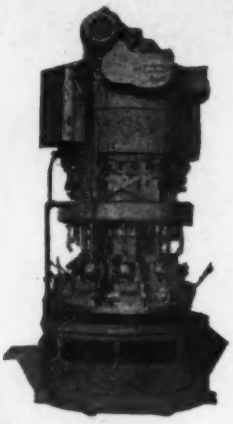

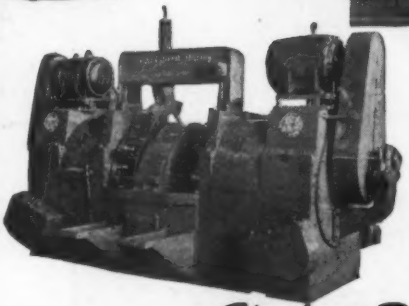

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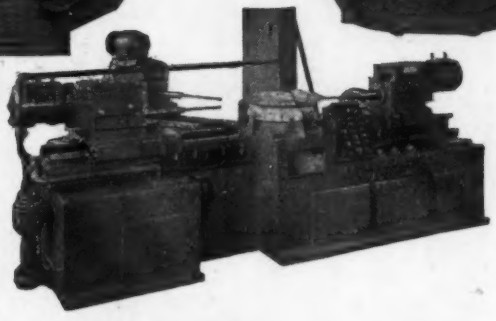

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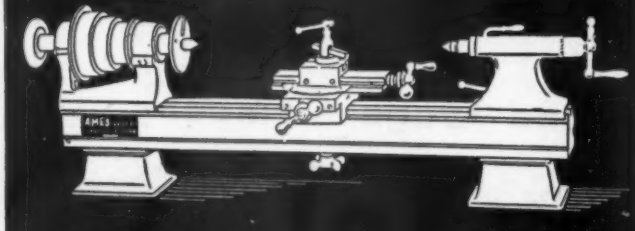

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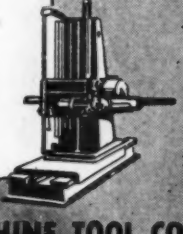

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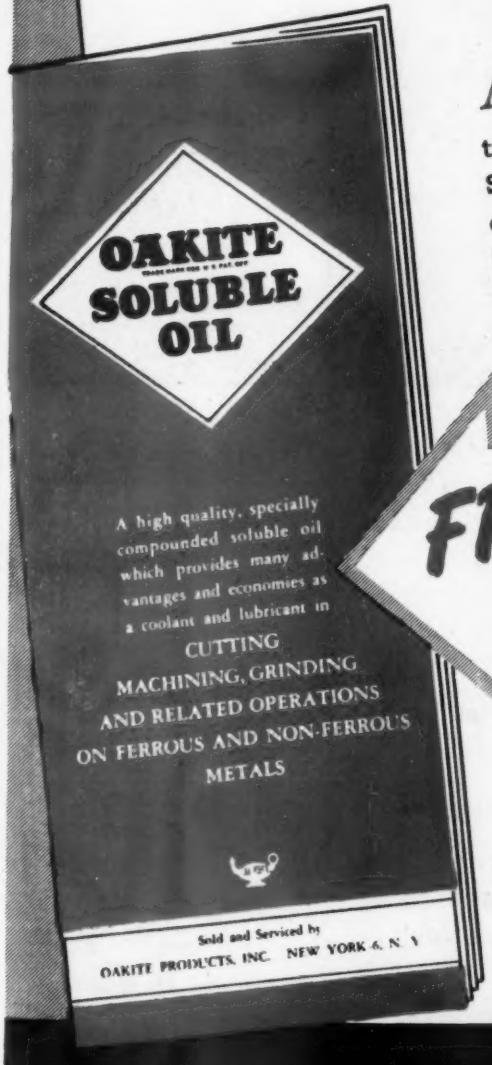
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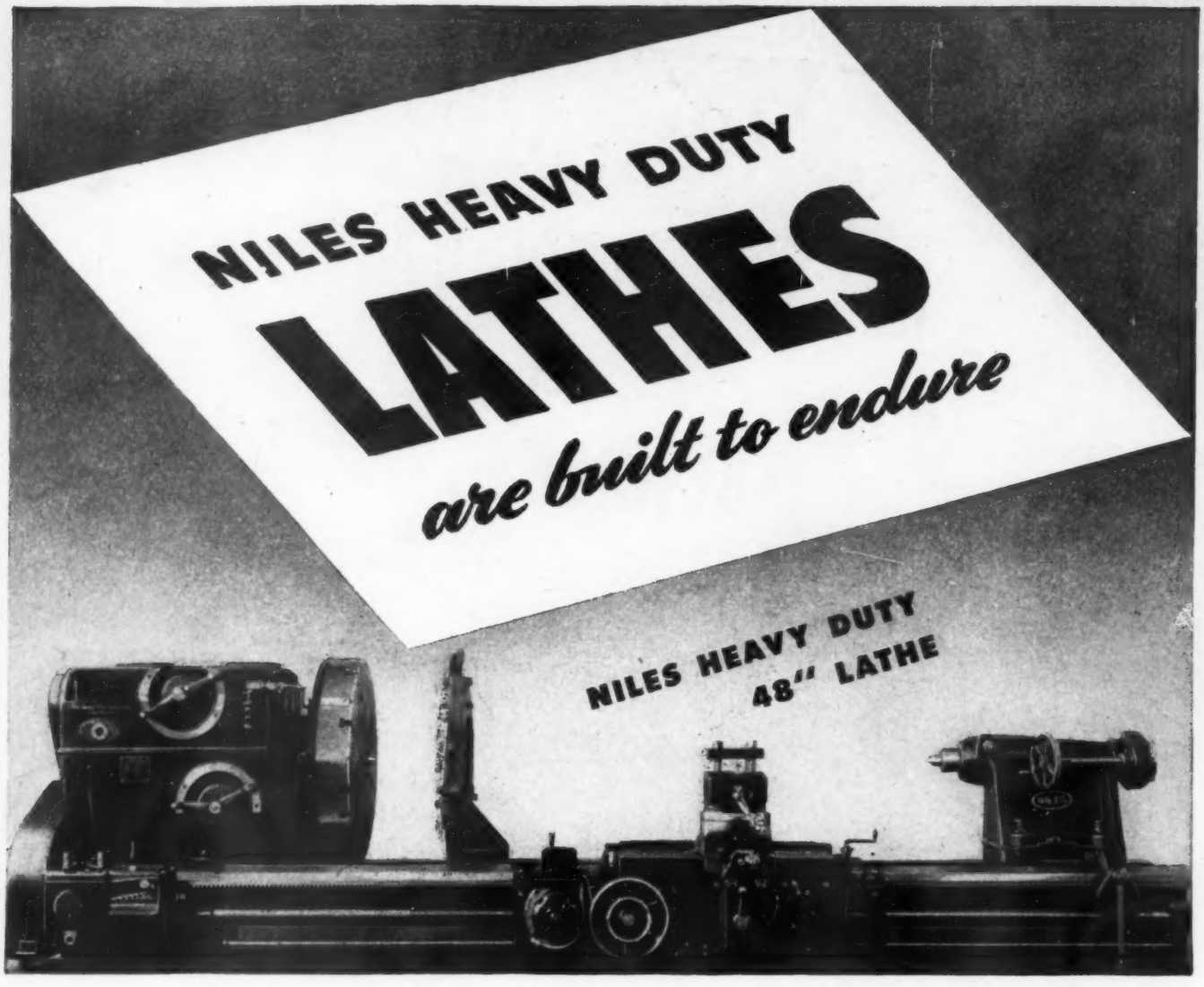

● Over a hundred years of experience in building machine tools have gone into the design of the Niles line of Heavy Duty Lathes. Made in 36″, 42″, 48″, 60″ and 72″ sizes and larger, they are built with such a generous reserve of strength that accuracy is maintained under the most severe operating conditions. Niles Lathes are outstanding for their simplicity, ease of operation, safety and dependability.

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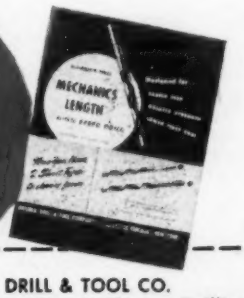
New bulletin gives sizes, prices, advantages of the new Republic Mechanics Length Drills...Use the coupon to get your copy.



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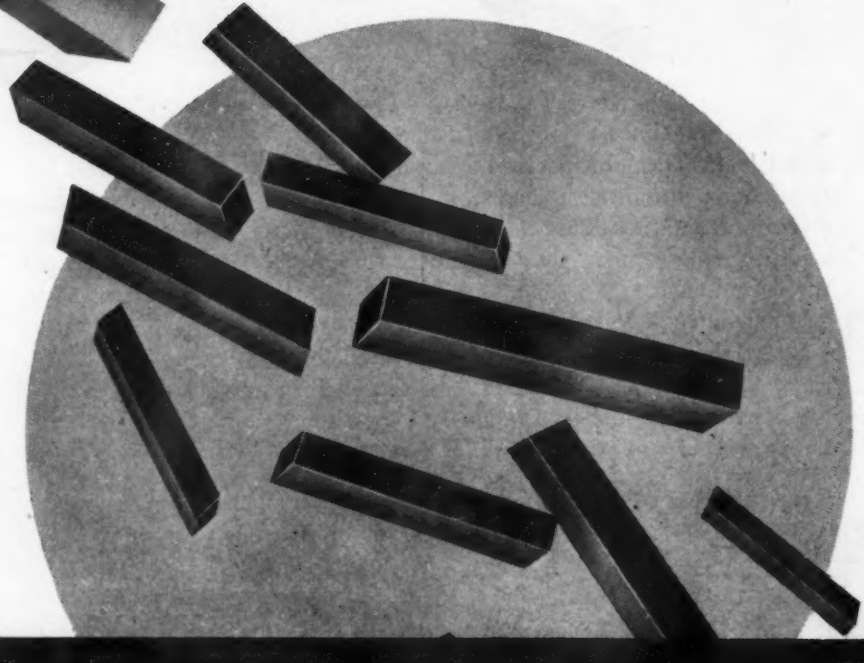

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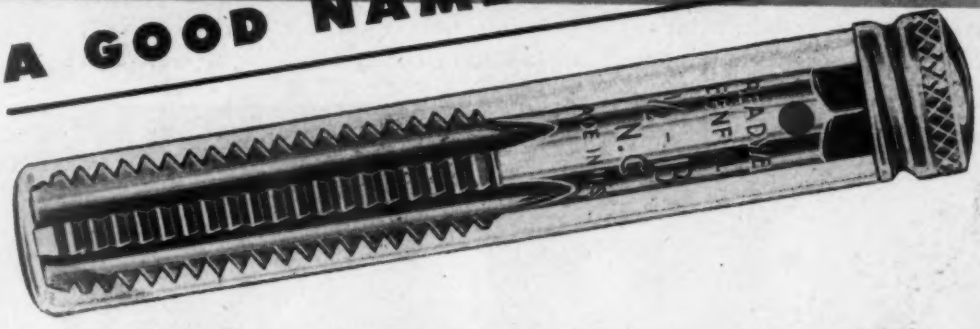

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New Transparent Cutting Oils • Increase Production, Prolong Tool Life, Lower Over-all Costs!

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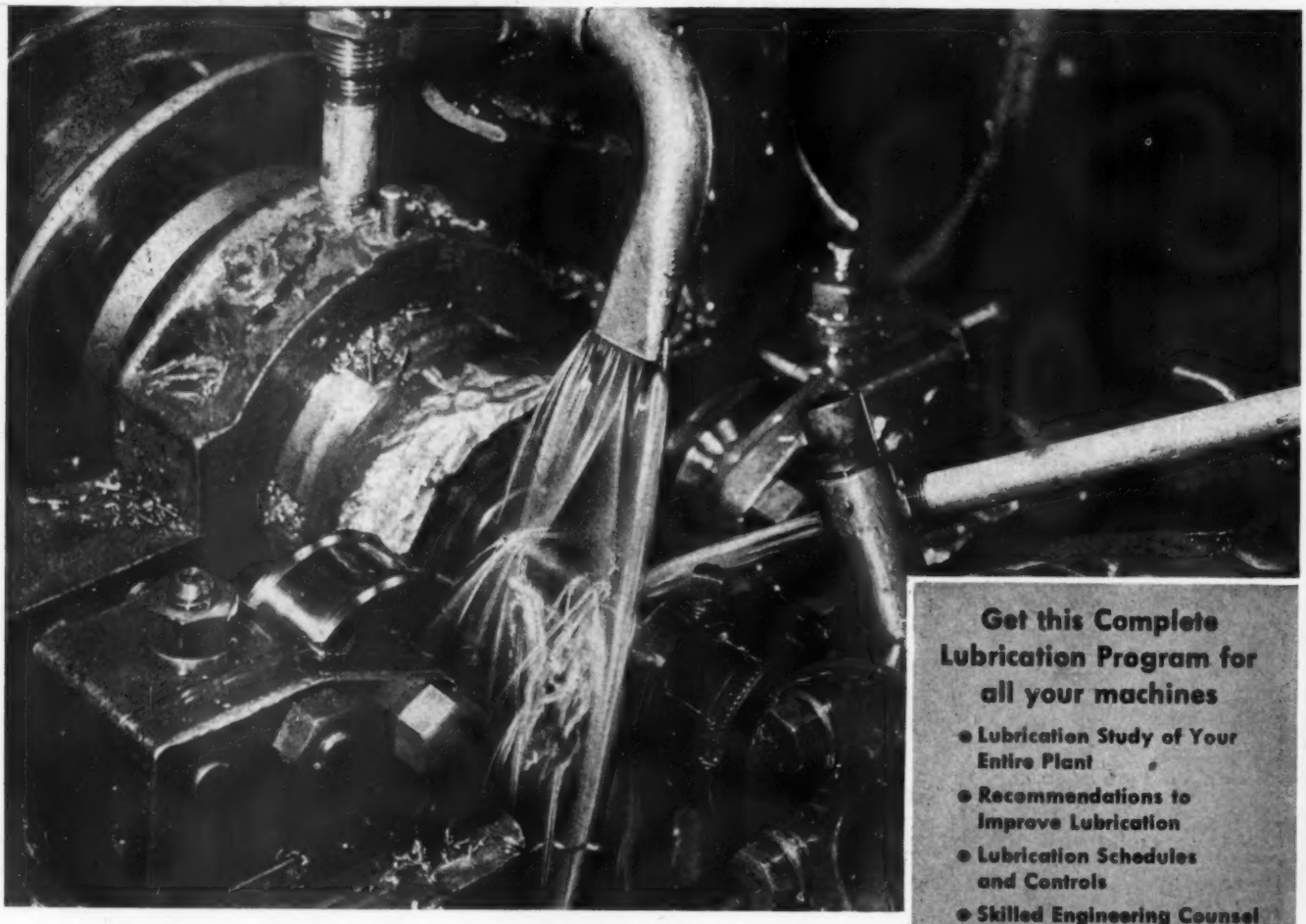
The reports cover virtually every possible cutting operation—turning, milling, thread-cutting and grinding, drilling, reaming, tapping, broaching, gear-cutting and hobbing. Analysis in all cases shows savings that mean lower over-all production costs.

S/V Sultrans are a new development in cutting oils. Their light color and transparency mean better visibility that helps in precision operations. Their high lubricity and anti-weld characteristics make possible deeper, faster cutting and prolong tool life. And their odorless quality makes them popular with operators. Try these new oils now in your plant!



S/V Sultran B40 used in drilling and reaming operation on Brown & Sharp Automatic. SAE 1020 steel; speed 145 s. f. m., .001" tolerance on hole. Feed: .004" on drill, .006" on reamer. 34 seconds cycle time. Tool life 8 hours.

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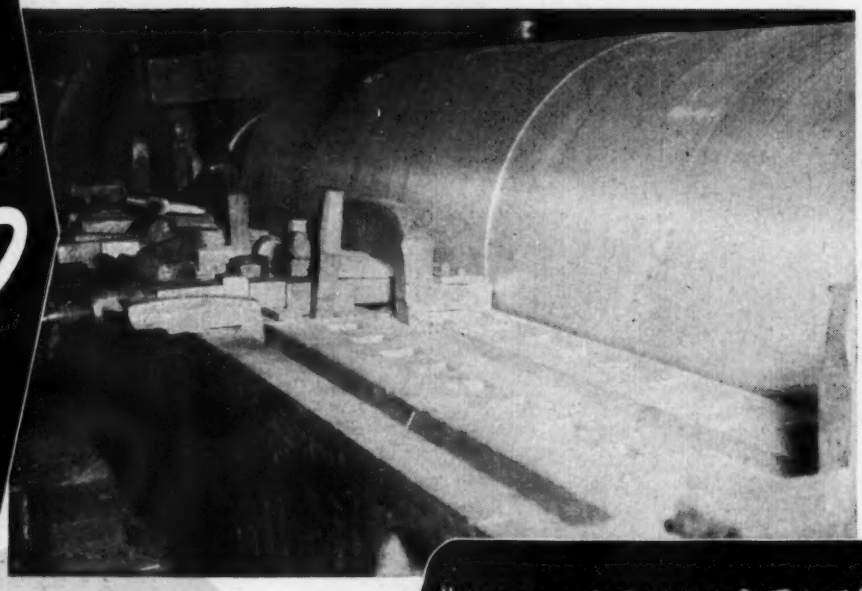

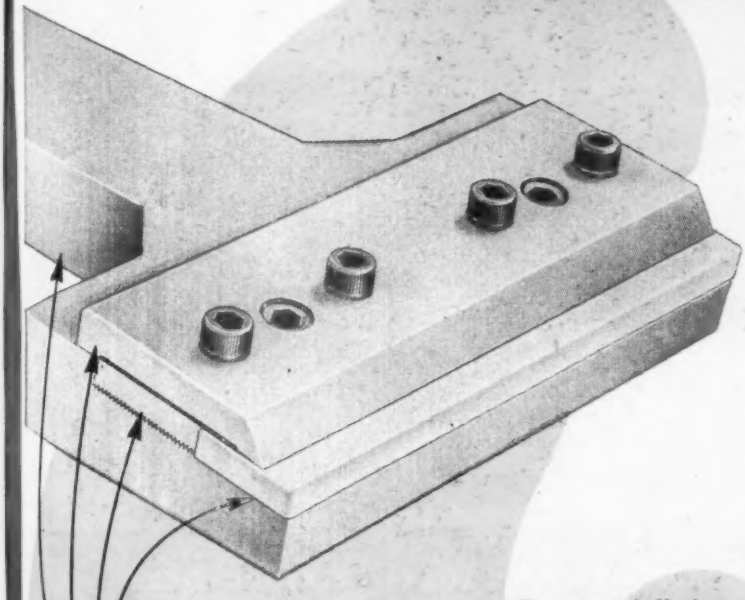

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- Shank, clamp, and back-up plate are heat-treated steel.

Cataloged in four standard sizes — cutting widths of blades: 4", 6", 8", and 10". Other sizes can be made on special order.

"UNMACHINABLE" CHILLED CAST-IRON ROLLS

[UP TO 90 SCLEROSCOPE]

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KENNAMETAL ROLL-TURNING TOOL

Turning chilled cast-iron rolls costs far less than the traditional process of grinding—and here's the tool that can turn even "unmachinable" castings—up to 90 Scleroscope . . .

A sturdy Kennametal Grade K6 blade is securely held in place on an accurate surface of the supporting shank by a clamp and serrated, advanceable back-up plate—each of hardened steel.

The blade has four cutting edges that may be used in succession before any sharpening is required. Then it can be reground time and again (long sides only) and advanced each time to cutting position, until ⅔ of it has been utilized.

There's one positive way to prove this new Kennametal tool can greatly reduce your cast-iron roll production costs—and that's under actual working conditions in your shop. We'll demonstrate—invite us.

*For example, a roll that required 25 hours for rough grinding was turned with two 8" Kennametal Tools in 8½ hours.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

TRADE MARK REG. U. S. PAT. OFF.

KENNAMETAL Inc., LATROBE, PA.

Save 5 Ways...

with SIEWEK Fixture Clamps and Fittings

- Cut fixture designing and drafting time 50% to 75%
- Adaptability to many jobs avoids need for specials
- Hold work securely... No slipping... No spoiled work
- Quick acting... Saves valuable time on all production
- Eliminate service of toolmaker—9 times out of 10

24 DIFFERENT TYPES
3 SIZES EACH

Announcement!

The widely popular line of Siewek Rapid Clamping Jigs and Siewek Fixture Clamps and Fittings now under new ownership of experienced management, design and technical executives.

Also... JACKS • JACK LOCKS • FIXTURE LOCKS
REST BUTTONS • RESTS AND CAMS • HAND KNOBS

Instead of designing "specials," use Siewek clamp assemblies and parts... the time saved in planning and drafting pays for the cost of the complete assemblies. We furnish full size template drawings to trace from when making layouts.

Heat-treated and hardened Siewek clamp bars give years of service—with ample safety margin. Uniform, right-angle pressure assures secure holding. Write today for full size template drawings for layout use.

SIEWEK TOOL COMPANY

2862 EAST GRAND BOULEVARD **DETROIT 2, MICHIGAN**

Distributors in Principal Cities

PAGE *Gas* WELDING RODS

PAGE now offers two new bronze rods for oxyacetylene welding – both up to the well-known PAGE high standard of quality and uniformity. Each of these rods has many applications in maintenance and production. For specific information about these – or any other type of electrode or gas welding rod – get in touch with your PAGE distributor.

ACCO

Monessen, Pa., Atlanta, Chicago, Detroit, Denver, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Bridgeport, Conn.

TRADE MARK

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

Blades made for the job COST LESS

Only from a complete line can you be sure of getting the blades that cut cleanest, fastest, longest on *your* work.

The Victor line is *complete*. And your Victor supplier can help plenty in advising "which blade for what use." See him. And for further money-saving help, ask him for Victor's booklet of hack saw hints. There's a copy waiting for you, free.

VICTOR MOLY HIGH SPEED
• HAND BLADES

VICTOR HIGH SPEED
• POWER BLADES

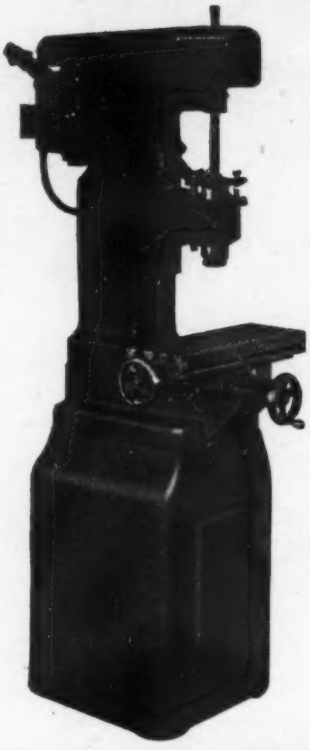
• FRAMES

• BAND SAWS
(including skip-tooth)

Sold Only Through Recognized Distributors

VICTOR
SAW WORKS, INC.
Middletown, N. Y.
Makers of hand and power hack saw blades, frames and metal cutting band saw blades.

TREAT YOUR TOOLROOM TO A LINLEY



Toolmakers appreciate this small, fast, accurate miller and jig borer for work on dies, jigs, fixtures, patterns and models. Cuts costs, too, by *not* tying up larger, higher rated machines.

Setup is easy . . . changeover fast. Has 8 spindle speeds to 4250 r.p.m. for a variety of work. Micrometer setting is direct. All rotating parts are carefully balanced for velvet-smooth operation. Design insures anti-backlash in quill travel.

Has table travel of 10" lengthwise, 6" crosswise . . . table top, 7" x 17½", is ample.

Get Bulletin for details.

LINLEY BROTHERS COMPANY
664 STATE ST. EXTENSION
BRIDGEPORT 1, CONNECTICUT

DRILL 6 HOLES AT ONE STROKE!—ADJUSTABLE FOR ANY PATTERN

Multiply the production of every drill press . . . make your single spindle tools do the work of 6 with the Multi-Drill attachment. Six spindles are quickly and easily positioned to ***any*** hole pattern by simple adjustments of the locating arms. Fits any drill press. Standard Multi-Drill Spindles using 1/16" to 17/64" drill size handle any hole pattern on or within 5" circles—11/16" minimum centers.

SAVE:
- Drilling time
- Set-up time
- Equipment investment
- Floor space

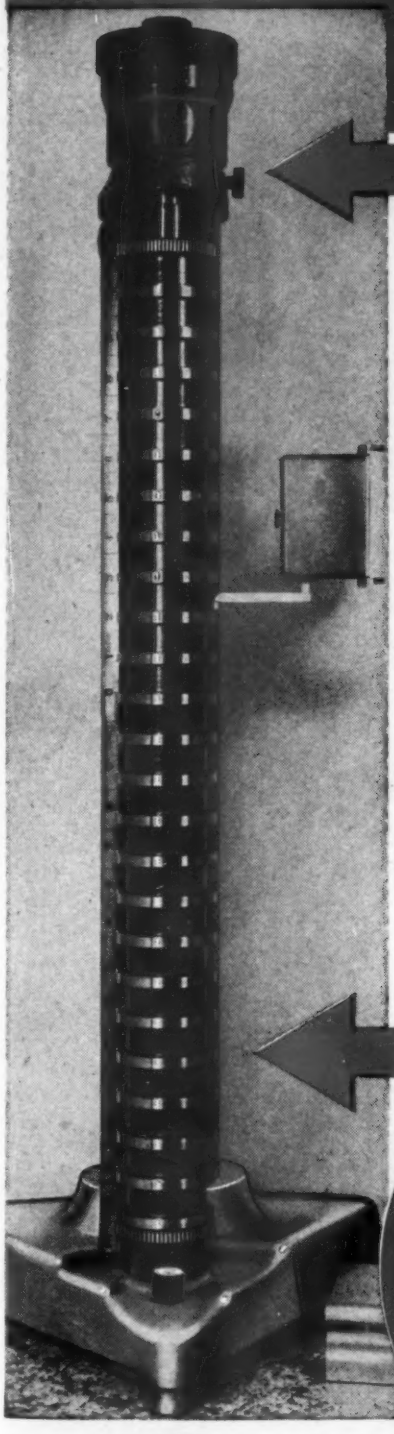
NOTE: Special spindles are available to permit use of drills 1/16" to 3/16" diameter with corresponding minimum centers of 1/2" and 7/8".

Write for catalog sheets and complete details

COMMANDER MFG. CO.
4239 W. Kinzie Street
Chicago 24,
Illinois

SETTING TIME: 10 SECONDS! ACCURACY: .0001" in 24"!

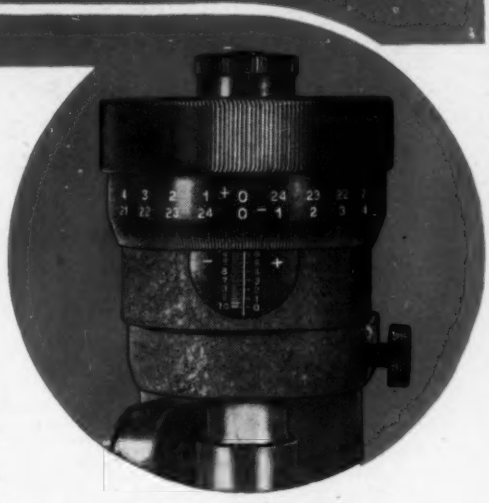
Cadillac PLA-CHEK SPEEDS CLOSE TOLERANCES DEMANDED BY POST WAR JOBS



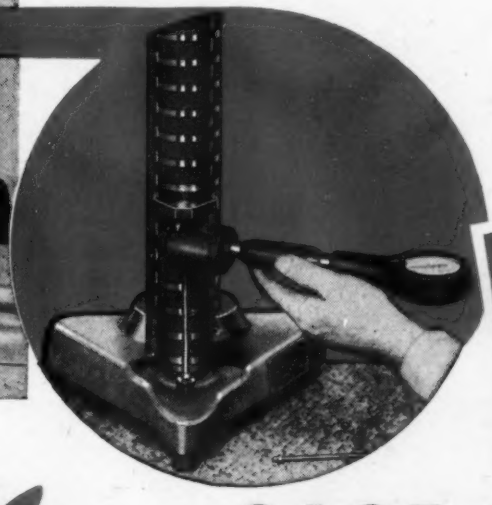
● Get This New 24" Model PLA-CHEK for FASTER . . . MORE ACCURATE INSPECTION.

PLA-CHEK is *guaranteed* accurate to .0001" in 24". An adjustable measuring bar with an endless scale graduated from zero to 24 inches each way establishes the minute tolerances demanded today . . . quickly, easily, accurately. The micrometer thimble graduated *plus* or *minus* enables the user to check *up* and *down* from the center line of work.

A reverse checking plate may be quickly and easily clipped to any one-inch step on the Pla-Chek bar. The lower measuring flange is set even with the lapped button with the micrometer thimble set at zero. Inside micrometers, telescoping gages, or internal cylinder gages can be set directly between the button and the reverse checking plate by merely setting the micrometer thimble to desired dimension.



MICROMETER THIMBLE—Arrow indicates 1" of measuring sleeve travel in addition to 1" of micrometer travel. This enables user to measure directly from center or reference line of job.



REVERSE CHECKING PLATE—Speeds setting of many type gages.

Body heat does not affect the findings of Pla-Chek. There is no contact between the inspector's hands and the measuring bar. Speed your postwar inspections with this new Pla-Chek . . . the astounding new gage for surface plate work.

TRY IT BEFORE YOU BUY IT!
See how much time PLA-CHEK will save you. We will be glad to send it on two-weeks free trial. If this trial satisfies you, send your check. If not, return PLA-CHEK express collect and you owe us nothing. Write, Wire, or Telephone. Reverse the Charges! Telephone: PRospect 1644.

Cadillac GAGE COMPANY

20316 HOOVER ROAD DETROIT 5, MICHIGAN

"IF IT'S A JACOBS, IT HOLDS"

Jacobs

WITHOUT EXCEPTION ALL THE FAMOUS MAKERS OF DRILL PRESSES EQUIP WITH

Jacobs Chucks

To make certain that the accuracy built into their drill presses shall not be lost through inaccurate chucks, the manufacturers of drill presses equip them with Jacobs Chucks – the standard of the world for accuracy and all-'round dependability. The superior performance of Jacobs Chucks is recognized by manufacturer and user alike. Among their features are:

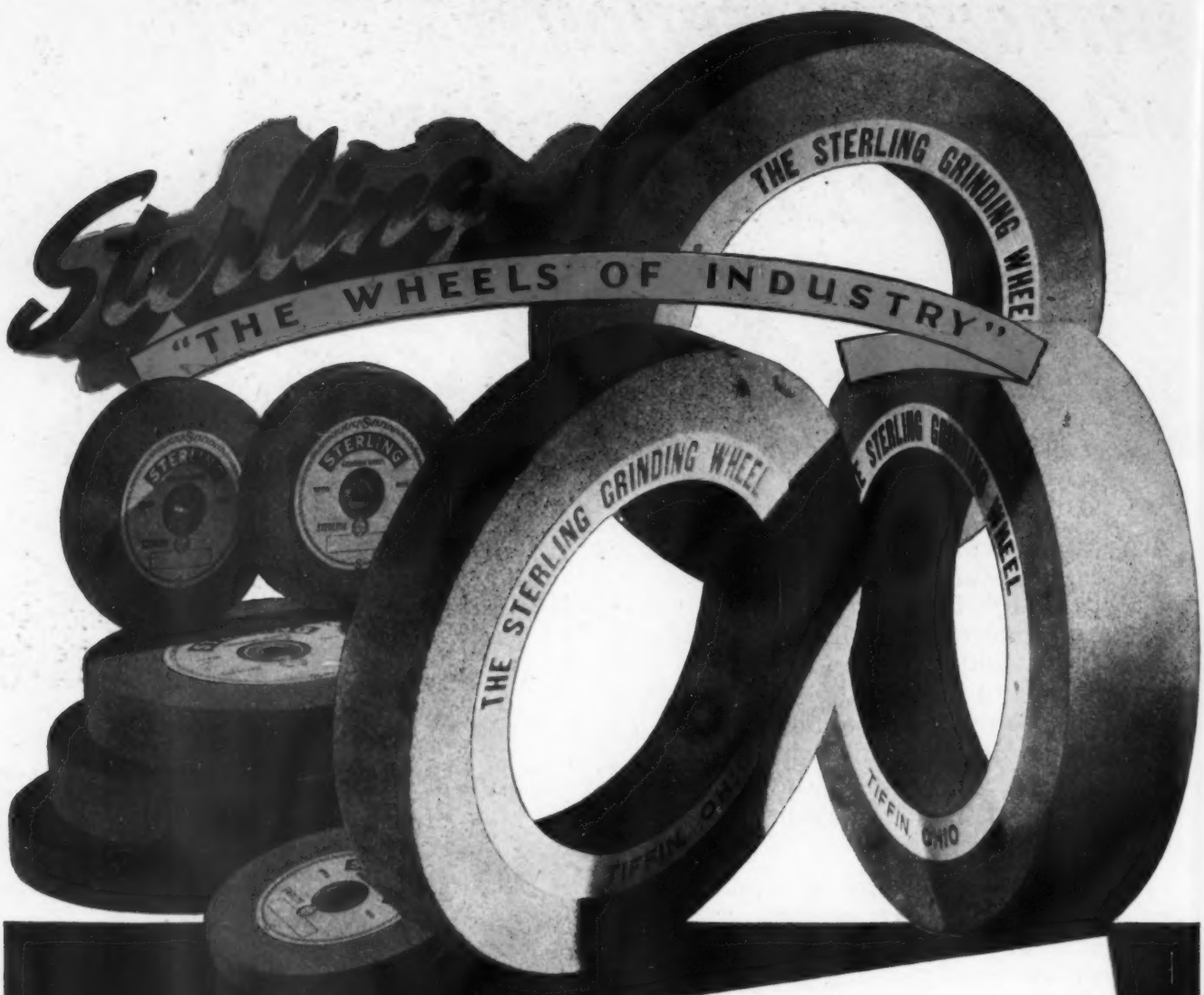
Nickel alloy steels for strength and toughness – Areas subject to wear carefully surface hardened – The hardened and ground body has diamond-bored taper hole for great accuracy – Lands are heat treated for extreme hardness with adequate core strength retained – Modern easy-grip sleeves are ground simultaneously on three dimensions for absolute balance – Tools may be readily changed and are always accurately centered with a sure grip – Minute tolerances permit ready interchangeability of parts.

There's no premium on these advantages – advantages that earn their way in shop or product – because Jacobs Chucks are always reasonably priced.

Jacobs Plain Bearing Key Chuck

Chucks

THE JACOBS MANUFACTURING COMPANY
Hartford, Connecticut



Send for the Specification Selector Today!

◆ Ask for your free copy of this handy grinding reference . . . tells the correct wheel to use for almost any job.

STERLING'S "Wheels of Industry" have successful grinding built into them . . . there is the correct grain size, structure, bond, size and shape to do either the ordinary or unusual job.

For over sixty years, the "Wheels of Industry" have been solving difficult grinding problems—you "cash in" on this experience when you use Sterling Grinding Wheels.

Sterling's laboratory technicians and engineers are ready to produce for you the wheel for the job that "can't be done." Write us for this service . . . there is no obligation.

• STERLING ABRASIVES •

THE
STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

L-W Magnetic Chucks

Guaranteed maximum holding power. Well constructed for long life.

Guaranteed waterproof for wet or dry grinding.

Equipped with connections to operate on either 110 or 220 volt D. C.

Size	**5¾" x 13"...**	**$ 47.65**
Size	**6½" x 18"...**	**63.15**
Size	**8" x 24"...**	**109.30**
Size	**10¾" x 37"...**	**202.05**

DEMAGNETIZERS

A single pass over the stationary poles is sufficient to completely demagnetize work that has become magnetized through induction. Model B-2 for large work, complete with pilot light signal, switch and cord. 7¾" wide, 12½" long, 6¾" high. Shipping weight 55 lbs. $63.20.

Model J-1 for small work, complete with switch and cord, 7¼" wide, 4¼" long, 6¾" high. Shipping weight 35 lbs. $41.15.

RECTIFERS

For converting A. C. into D. C. for use on magnetic chucks. A. C. input 110 volts. D. C. output 110 volts, 8 amps. Suitable for use with L-W 5¾"x13" and 6½"x 18" magnetic chucks. Two tubes provide ample capacity. $38.75. Larger capacity rectifiers also available.

DEMAGNETIZING SWITCHES

for use on our two larger size magnetic chucks. When the switch is thrown to "ON" position, the chuck is magnetized, and the work held firmly for grinding. When the work is to be released, the switch is thrown to "DEMAG" and contacts are touched momentarily to neutralize the chuck. Field discharge type $16.25.
L-W Demagnetizing Switch $8.90.

Send for complete catalog giving prices and specifications on these quality, low-cost L-W Products

L-W CHUCK COMPANY

25 SO. ST. CLAIR ST.
TOLEDO 4, OHIO

Don't send an ordinary file to do

A PRECISION JOB!

specify . . .

American Swiss Files

Whenever you have a particularly difficult filing job, just look in the "AMERICAN SWISS" catalog—you'll find an exactly suitable file among the 3000 listed shapes, sizes and cuts.

When the work is *fine*, remember that some "AMERICAN SWISS" files are made to tolerances as close as .002 in.—and some shapes are obtainable in dimensions as small as 1/8 in. and less.

When the work is *heavy*, remember that "AMERICAN SWISS" files are made of the highest grade file steel—no ordinary tool steel is used—and specially heat-treated to assure extreme toughness and uniform hardness. When you specify "AMERICAN SWISS" you are selecting a precision tool which has been so rigidly inspected that its quality is guaranteed. For 45 years the "AMERICAN SWISS" standard has been: "Only the best are "good enough".

Buy From Our Distributor

AMERICAN SWISS FILE & TOOL CO.

ELIZABETH 1 • NEW JERSEY

ASK FOR THEM BY NAME

American Swiss

SWISS PATTERN FILES

Almond Drill Chuck

The Pioneer

Almond Three-Jaw Drill Chucks were Pioneers in their field—the first to be placed on the market. They have formed a necessary part in the logical procedure of machine developments over the past seventy and more years.

Almond Drill Chucks are made in types and sizes *to fit all machine tools and portable drills.*

Write for complete details

T. R. ALMOND MFG. CO.

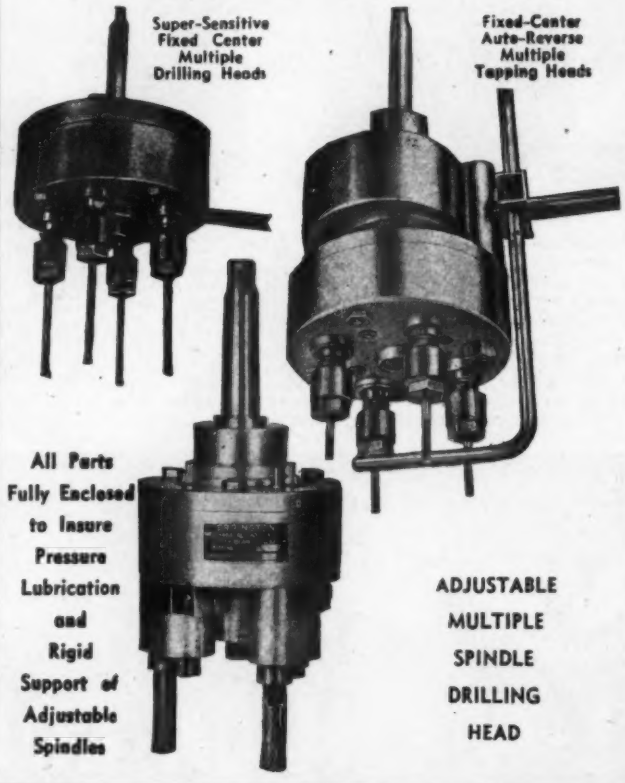
ASHBURNHAM, MASS., U. S. A.

The Original Manufacturers of Drill Chucks

ERRINGTON MECHANICAL LABORATORY

STAPLETON, STATEN ISLAND 4, N. Y.

MULTIPLE HEADS


Super-Sensitive Fixed Center Multiple Drilling Heads
Fixed-Center Auto-Reverse Multiple Tapping Heads
All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles
ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

Get more work out of your Hanchetts and Blanchards with Robertson Wheels

Whether you're working on small pieces or on 30" x 30" boiler plate, you'll get better results from your Hanchetts and Blanchards if they're equipped with Robertson Cool-Cut Segmental Wheels or Ring Wheels.

These precision-built wheels have proved their ability, time and again, to cut grinding time in half—*or better*. Because of the special Cool-Cut structure, only a few grains are used at a time, providing an unusual degree of chip clearance. The bond holds the cutting grains to the limit of their effectiveness. This increases the life of the wheel and assures cool cutting on the hardest of metals.

One large company, operating on half-inch-thick boiler plate thirty inches square and with a ten-inch hole in the center, was taking 45 minutes to remove .050" stock from one side. Ampere reading was 67-75. When they equipped the Blanchard with a Robertson Cool-Cut Segmental Wheel, grinding time was cut to 20 minutes (less than half the previous time). Feed was stepped up 25%. Ampere reading dropped to 45-50.

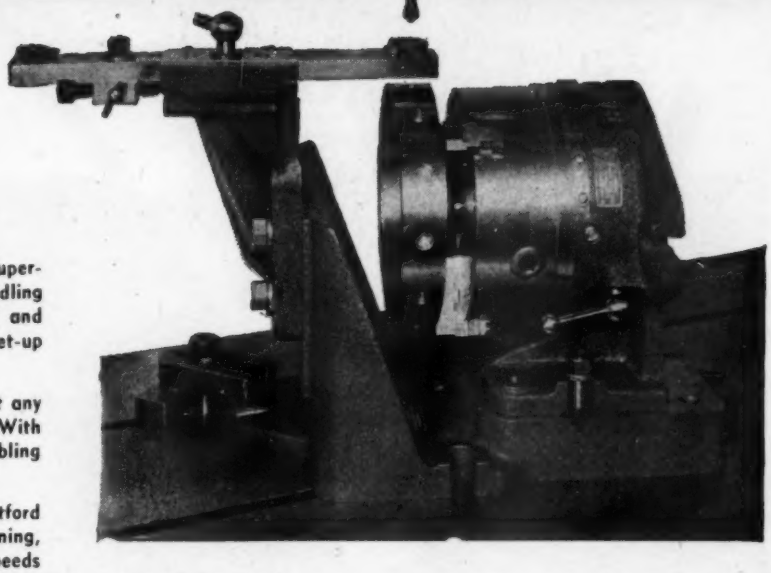
Results such as these, obtained on difficult boiler plate grinding operations, should suggest to you the advisability of using Robertson Cool-Cut Wheels to solve many of your other difficult grinding problems.

Write for a free copy of the booklet, "How to Buy Production-Time," which tells all about Robertson Cool-Cut Wheels.

ROBERTSON MANUFACTURING COMPANY
TRENTON 5, NEW JERSEY
Manufacturers of Vitrified-Bonded Grinding Wheels • Mounted Wheels • Segments

RADIAL DRILLING INDEXING

conveniently handled with the HARTFORD SUPER-SPACER



The Hartford Radial Drilling Attachment, secured to the Super-Spacer base, provides a simple, practical means of handling radial drilling indexing operations. Variations in length and diameter in radial drilling can be easily taken care of. Set-up time is negligible.

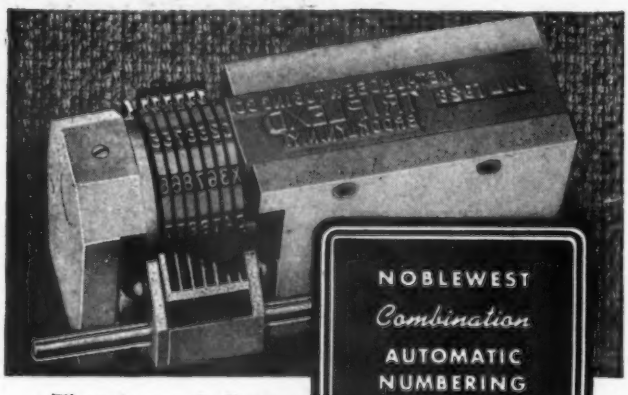
The Hartford Radial Drilling Attachment is designed to fit any standard Super-Spacer and can be added at any time. With it, the utility of the Super-Spacer is greatly extended, enabling users to get more work from this device.

Other indexing operations within the wide scope of the Hartford Super-Spacer include plain drilling, milling, slotting, planing, grinding and jig boring. Work is held securely, faster speeds and feeds are permitted, accuracy maintained and all chance of error eliminated by mask plates. Skilled operators are not required.

INVESTIGATE—Send at once for illustrated booklet showing a few of the many typical applications of the Hartford Super-Spacer in today's production. No obligation.

THE HARTFORD SPECIAL MACHINERY COMPANY

HARTFORD 5, CONNECTICUT



There's practically no limit to combinations for marking and consecutive numbering that Noblewest can supply. Model 131, above, shows a Noblewest automatic numbering head combined in one marking tool with an interchangeable flat marking die. All Noblewest marking tools are of the very finest quality. Write Noble & Westbrook Manufacturing Co., East Hartford 8, Conn.

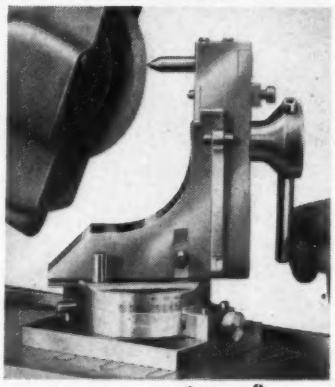
MARK IT BEST WITH

NOBLEWEST

Fine Marking Tools

The makers of **LIONEL ELECTRIC TRAINS** *give four reasons for their choice of*

"Fluidmotion"* RADII and ANGLE DRESSERS



1. Exceptional accuracy of "Fluidmotion" in all phases of form dressing.
2. Much easier set-up and operation.
3. "Fluidmotion" allows them to dress the entire angle-radius-angle profile on wheel in *one continuous motion* — with just *one* set-up.
4. Substantial saving in wheel cost, since accuracy results in less material being removed at each dressing.

"Fluidmotion" FEATURES:

- *0001" accuracy*
- *Automatic centering*
- *"Fluidmotion" dressing*
- *Dustproof and chatterless*
- *Hardened stainless steel*
- *7" & 14" wheel capacities*
- *Highest quality diamonds*

These are basic reasons for the choice of "Fluidmotion" Radii and Angle Dressers at Lionel and other well known plants throughout the country. There's a standard "Fluidmotion" Radii & Angle Dresser for most requirements. Send for descriptive bulletins.

*Reg. U. S. Pat. Off.

J&S TOOL CO. 477 Main St. East Orange 1, N. J.

Representatives in Principal Cities

For efficient lubrication the year-round, lower operating costs,

take these two easy steps

Call in a Gulf Lubrication Engineer

HERE'S a practical plan for modernizing your lubrication practice—to help your machines and equipment meet today's increasing production requirements.

Through Gulf Periodic Consultation Service you get effective and continuous assistance on your lubrication problems from an experienced Gulf Lubrication Engineer. This trained specialist will consult regularly with your operating and maintenance men—give you the benefit of latest developments in petroleum science.

Adopt Gulf Periodic Consultation Service

Call in a Gulf Lubrication Engineer today and ask him for additional information on this advanced plan. Write or phone your nearest Gulf office.

Gulf Oil Corporation • Gulf Refining Company, Gulf Building, Pittsburgh, Pa.
DIVISION SALES OFFICES: Boston • New York • Philadelphia • Pittsburgh • Atlanta • New Orleans • Houston • Louisville . Toledo

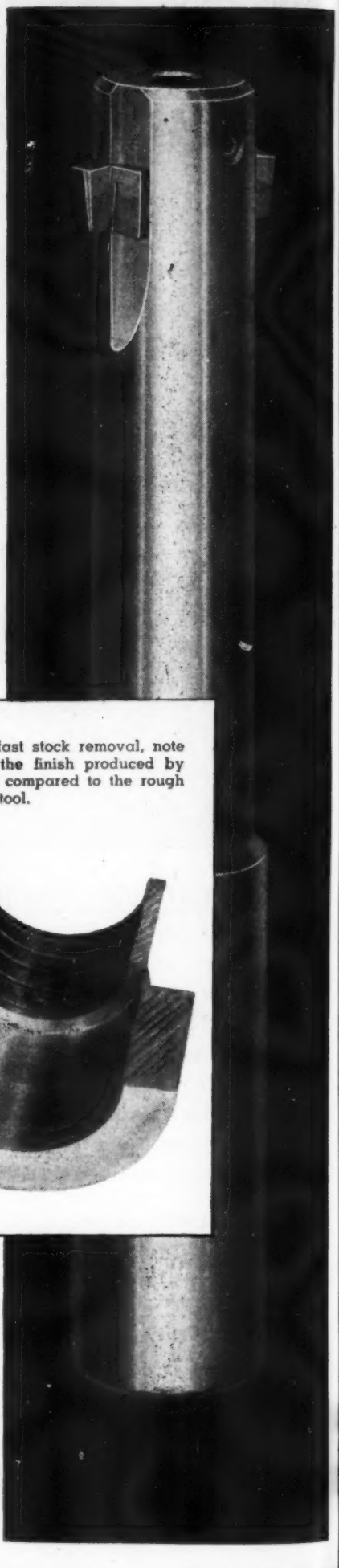
GULF INDUSTRIAL LUBRICATION

Helps make machines produce more at lower cost

YOU WANT SPEED?

This New MADISON Rough Boring Tool

SLASHES HOLE COSTS!



This new Madison Rough Boring Tool is the fastest changing, fastest cutting boring tool made. Team it up with the Madison Reaming Cutter and you'll get more accurate finely finished holes at lowest cost. Like the Madison Reamer, the Roughing Cutter can be easily set to decimal sizes within its range. Because cutters may be presized, disturbance of the setup is unnecessary when inserting a new or sharpened cutter in the bar. Cutter change is a matter of seconds. Simply back off the lock screw in the bar and the cutter slips out for resizing or replacement.

Because of the Madison locating feature the cutter is automatically centered and the load on cutting elements equalized.

The cutter block is formed by the Madison cutting blades themselves. This exclusive Madison feature creates a more rugged cutter with no delicate mechanisms or separate parts which may break or get out of order.

Madison Roughers have been used to bore holes as large as 17.590 and are made in the smaller range to 1" size.

These exclusive Madison features of simplified design are the reasons why the new Madison Rough Boring Tool performs with amazing speed. On field tests, stock removal requiring three passes with a conventional single point tool was executed in one pass with this new Madison Rougher.

Besides combining accuracy with fast stock removal, note on the production sample below, the finish produced by the Madison Rough Boring Tool as compared to the rough finish produced by a single point tool.

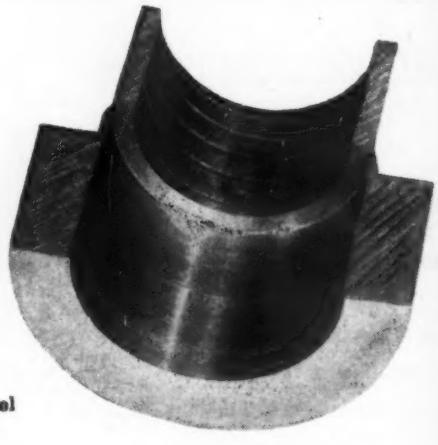
Material
Cast Steel.

Depth of cut
.697".

Feed
.0075" per revolution.

Surface speed
carbide tipped
352 FPM.

Surface speed
high speed steel
155 FPM.



Write for the Madison catalog today. Get the facts on Madison Boreamers, the tools that make one operation out of boring and super finish reaming.

MADISON MANUFACTURING COMPANY
DEPT. AM-4 **MUSKEGON, MICHIGAN**

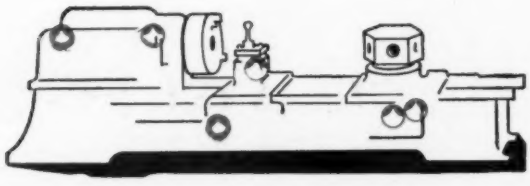
CODED LUBRICATION

tells your oilers 4 important facts... with simple numbers

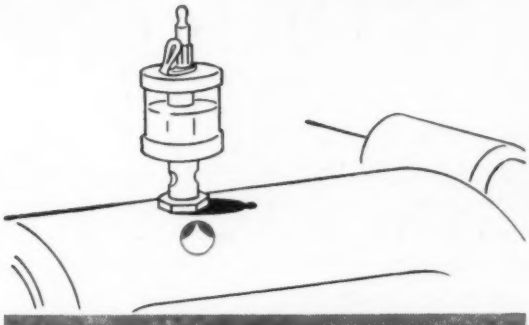
TROUBLED with getting the right lubricants in the right places? Standard's Coded Lubrication Service can help you. And it's easy to install and simple to follow.

Code numbers, not colors, are assigned to each lubricant used in your plant. Numbered decals are applied at each point to be lubricated, indicating which lubricant is to be applied. Every grease gun, oil can and storage container is numbered to indicate what lubricants are in them. Your oilers simply follow the numbers without having to remember brand names and grades.

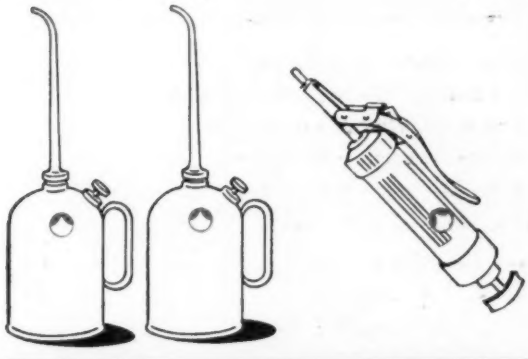
A Standard Oil Lubrication Engineer will be glad to discuss the application of Coded Lubrication in your plant. Call the nearest local Standard Oil office or write 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.



1. Where lubricant is needed



2. Which lubricant to use



3. Which oil can or grease gun to use

4. Which lubricant is in each storage container

TANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE

1946

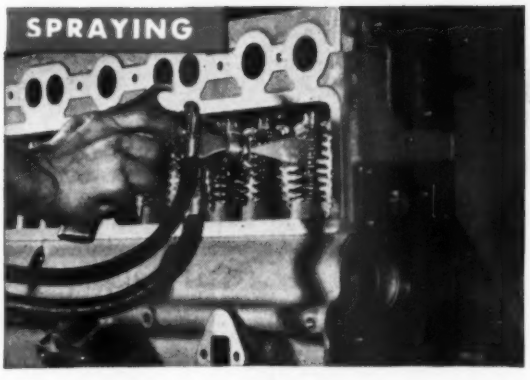
How to get the right rust preventive and the right application

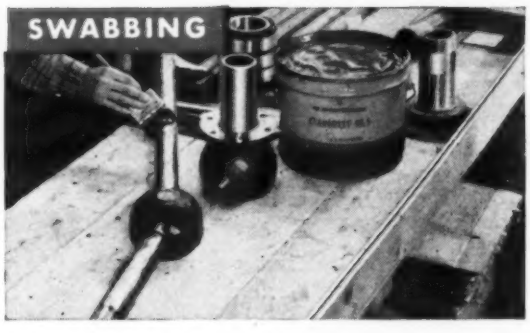
DO YOU WANT help in putting your rust prevention on a more economical basis—one that will assure full protection for parts during production, in storage, or in shipping? Do you want rust prevention that requires the minimum of labor for applying rust-proofing material?

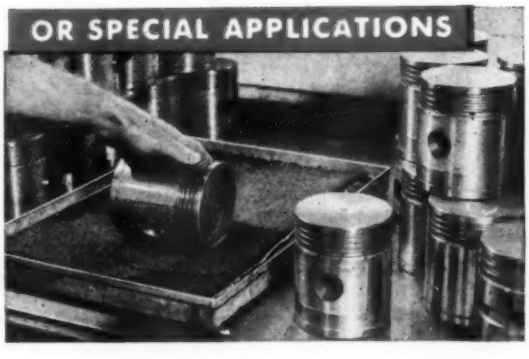
A Standard Oil Lubrication Engineer can give you real help. He has a tested line of rust preventives—Stanorust—plus many of the SR rust preventives approved for use on government equipment. He is familiar with the problems of applying various types of preventives and may be able to suggest shortcuts to save time and labor in your plant.

Put your rust prevention problem up to one of these Engineers. If your plant is in the Middle West, there's one near you. Call the nearest Standard Oil Company (Indiana) office or write, 910 South Michigan Avenue, Chicago 80, Illinois.

STANORUST includes grades for . . .







STANDARD OIL COMPANY (INDIANA)

STANDA SERVI

★ LUBRICATION ENGINEERING

A NEW BABY for our line . . .

and one that Requires Less Changing

BAYFLEX RAISED HUB DISC WHEELS

are outwearing coated abrasive discs on thousands of jobs. This is really good news for foundries, welding shops, sheet metal shops, automobile and truck body repair shops, or wherever grinding and polishing of any type of welded or brazed metal is a problem.

ADVANTAGES:

1—Flat surface and edge can be used for grinding. Edge can also be used for cutting off.
2—Excellent for grinding aluminum castings.
3—No "loading" under normal conditions.
4—Unexcelled for grinding into grooves and corners, and large radii on castings.
5—Will fit any standard machine using coated discs.
6—Bayflex discs, unlike coated discs, can be used efficiently right down to the nut. This means time and money saved.
7—Available in a variety of abrasive grit sizes.

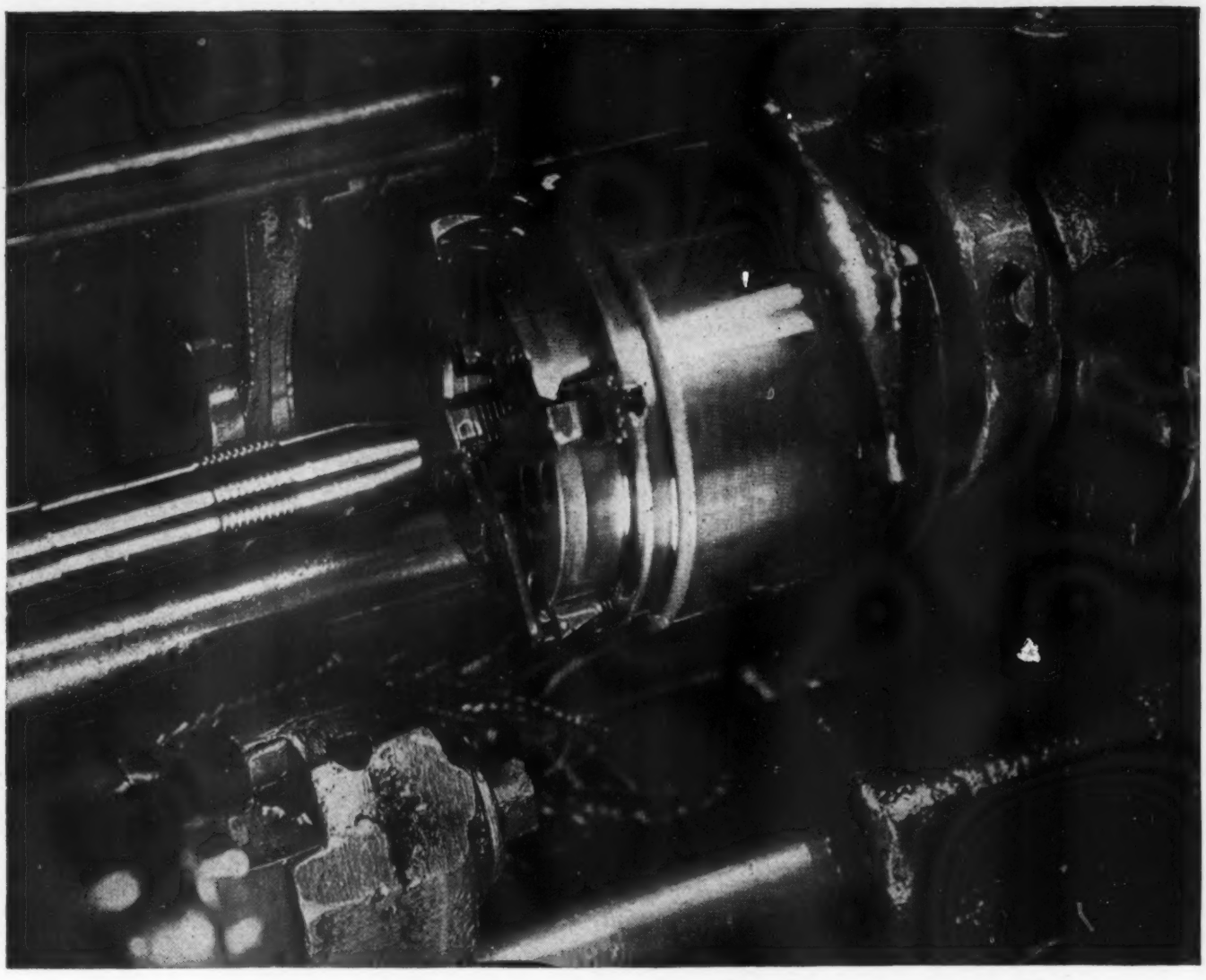
A trial will prove their worth. Write for bulletin for further information.

Branch offices and warehouses — Chicago — Detroit. Distributors — All principal cities.

BAY STATE

Top Performance Consistently Duplicated

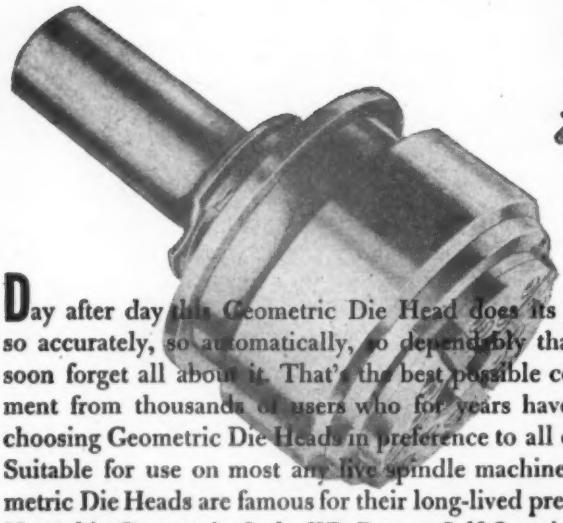
BAY STATE ABRASIVE PRODUCTS CO. • WESTBORO, MASSACHUSETTS, U.S.A.



A Die Head You Can Forget!

FOR NEARLY EVERY THREADING JOB—A GEOMETRIC!

If you have in mind a particular threading problem, we will be glad to have our engineers give you their recommendations, based on over a half century of specialization in this field. Why not let us send you the latest Geometric catalog?



Day after day this Geometric Die Head does its job—so accurately, so automatically, so dependably that you soon forget all about it. That's the best possible compliment from thousands of users who for years have been choosing Geometric Die Heads in preference to all others. Suitable for use on most any live spindle machine, Geometric Die Heads are famous for their long-lived precision. Here this Geometric Style KD Rotary Self-Opening Die Head is cutting a $\frac{3}{4}$"-16 N. F. thread on a hollow chuck component. Note its compact and rugged design, particularly adapted to multi-spindle automatic screw machines. ***Write for complete details about the "Style KD" and other Geometric Die Heads.***

THE
GEOMETRIC
TOOL COMPANY . . NEW HAVEN 15, CONN.
A Division of Greenfield Tap and Die Corporation

Improved

"MAXI"

Surface Treated Taps

You can again get "MAXI" surface treatment on "Greenfield" Taps at no extra cost.

"MAXI" was a pre-war champion when it came to tap performance. Today's "MAXI" is *better than ever.* Intensive research in "Greenfield's" metallurgical laboratory during the war has produced better formulas for surface treatment.

WHAT IS "MAXI" FINISH?

It is a heat treatment applied to High Speed Steel tools which imparts a surface hardness greater than that of an untreated tool. This surface is applied by a chemical bath. It does not affect the basic character of the metal nor the size of the tap.

COSTS NO MORE!

You can get a "MAXI" surface treatment on any "Greenfield" HIGH SPEED tool, regular or special, in any size at no additional cost. Simply add the word "MAXI" when ordering.

GTD

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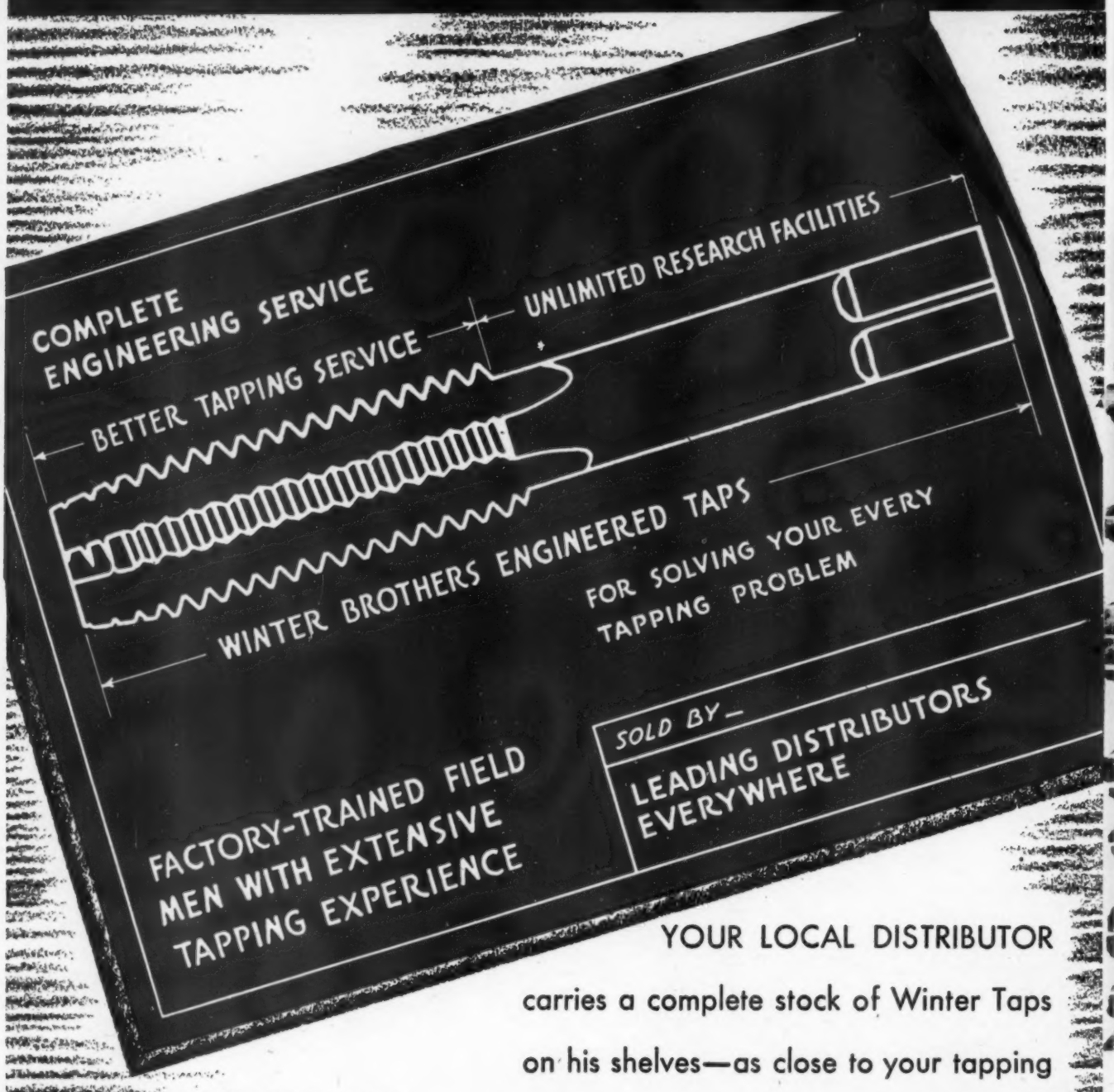
GREENFIELD TAP and DIE CORPORATION
GREENFIELD • MASSACHUSETTS

BLUEPRINT *for better tapping service*



YOUR LOCAL DISTRIBUTOR carries a complete stock of Winter Taps on his shelves—as close to your tapping problems as the phone on your desk

Winter Brothers

COMPANY · Wrentham, Massachusetts, U.S.A.

BRANCH STORES SAN FRANCISCO, CALIFORNIA · CHICAGO, ILLINOIS · DETROIT, MICHIGAN

A DIVISION OF THE NATIONAL TWIST DRILL & TOOL CO., ROCHESTER, MICHIGAN

THERE ARE 7 FACTORS TO CONSIDER WHEN YOU BUY GAGES

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Better design makes a gage easier and faster to use. VARD gages incorporate both war-taught rigid standards and the best of the post-war gage design engineering skills.

2 · · MATERIAL

A well designed gage is a good buy when its basic material fully meets use requirements. VARD gages are made of Timken Graph-Mo steel, hard chrome plate or boron carbide.

3 · · GRINDING

VARD gages are shaped on batteries of modern grinding machines—in temperature controlled rooms by expert gage-makers. Are ACCURATELY ground and lapped.

4 · · INSPECTION

Microscopic inspection equipment is necessary for gage testing. VARD owns visual and mechanical testing equipment of all types, some reading to .000001-in. That is accuracy!

5 · · PACKAGING

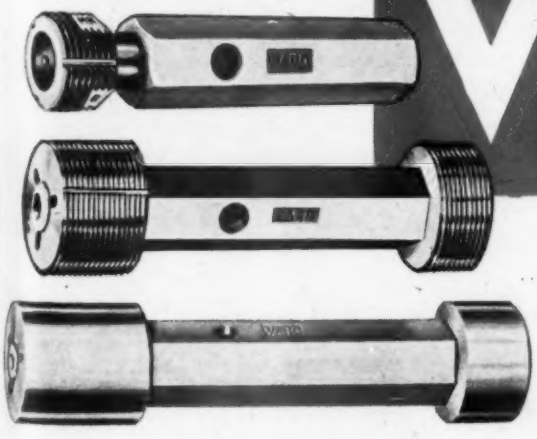
A gage properly made must still be safely delivered into your hands. VARD gages are wrapped in shock-resisting packing and then sealed in individual boxes or plastic tubes.

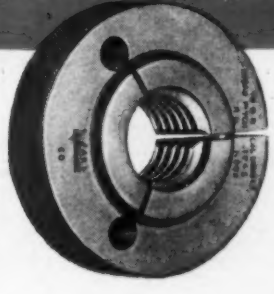
6 · · AVAILABILITY

VARD stocks most sizes of standard thread and dimensional gages. Our dealers also can supply you. Special gages are now produced in record time to your design.

7 · SERVICE GUARANTY

VARD guarantees its products against all defects of materials or workmanship. VARD can also rebuild or renew your worn gages. Write for our Gage Catalog or data on gages you need.

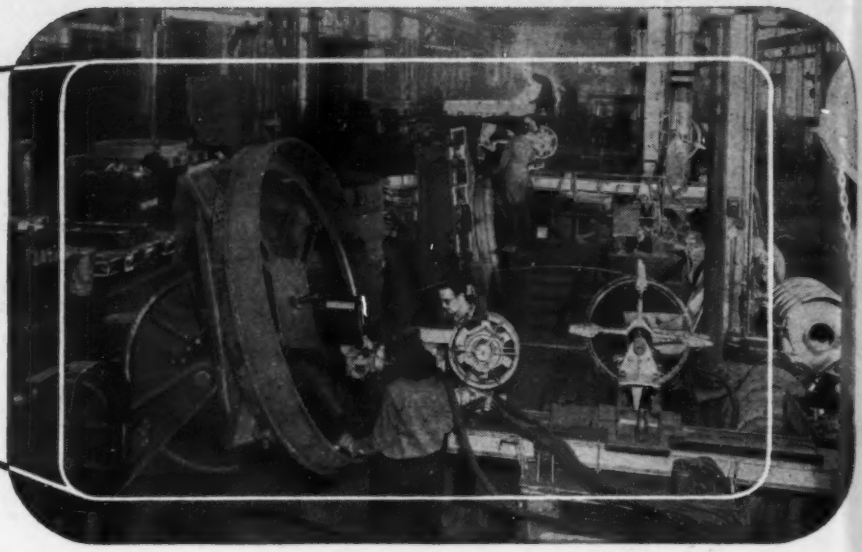




VARD INC. *Gagemakers*

2981 EAST COLORADO • PASADENA 8, CALIF.

Setting new standards in production welding



Matching their important contribution to faster production welding for war, C-F Welding Positioners are setting new standards in post-war welding practice. Shops already equipped with C-F Positioners are pacing the field in the race for new markets.

Equipped with variable speed control in any practical speed ratio, from 0 RPM and up, for handling circular or peripheral welds, C-F Positioners are speeding production welding practices everywhere. Speed selection is fast, easily made, permitting quick change-over of material being welded.

C-F Positioners as production tools are changing welding practice from slow, costly operations to faster, better automatic downhand welding. Cost of welding footage is reduced, "over-welding" is eliminated and machine or operator capacity is materially increased. There are hand or power operated C-F Welding Positioners in capacities from 1200 to 30,000 lbs. Write for illustrated bulletin WP 22. Cullen-Friestedt Company, 1313 South Kilbourn Avenue, Chicago 23, Illinois.

C-F positioned welds mean better, more economical welds

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

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THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER on Your Work

• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills—and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, and offset holes. We also manufacture oil-grooving millers.

Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

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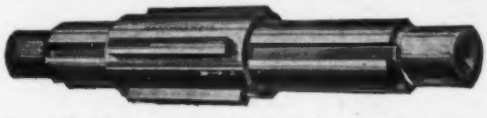
NATIONAL MACHINE TOOL CO.
CINCINNATI, OHIO

Save Time WITH NICHOLSON EXPANDING MANDRELS



These widely used tools cut costs for you 2 ways: by saving the time lost in making or looking for solid arbors; by promoting precision. Set of 19 Nicholson expanding mandrels does the work of 209 solid arbors.

Bulletin 1043

Other Products: Steam Traps, Control Valves, Arbor Presses, etc.

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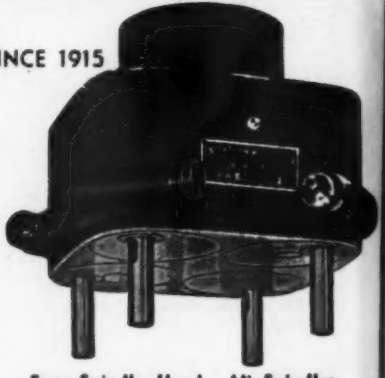
All Types of Fixed Center

DRILLING TAPPING & BORING HEADS



Four Spindle Head. All Spindles Adjustable for equally spaced holes.

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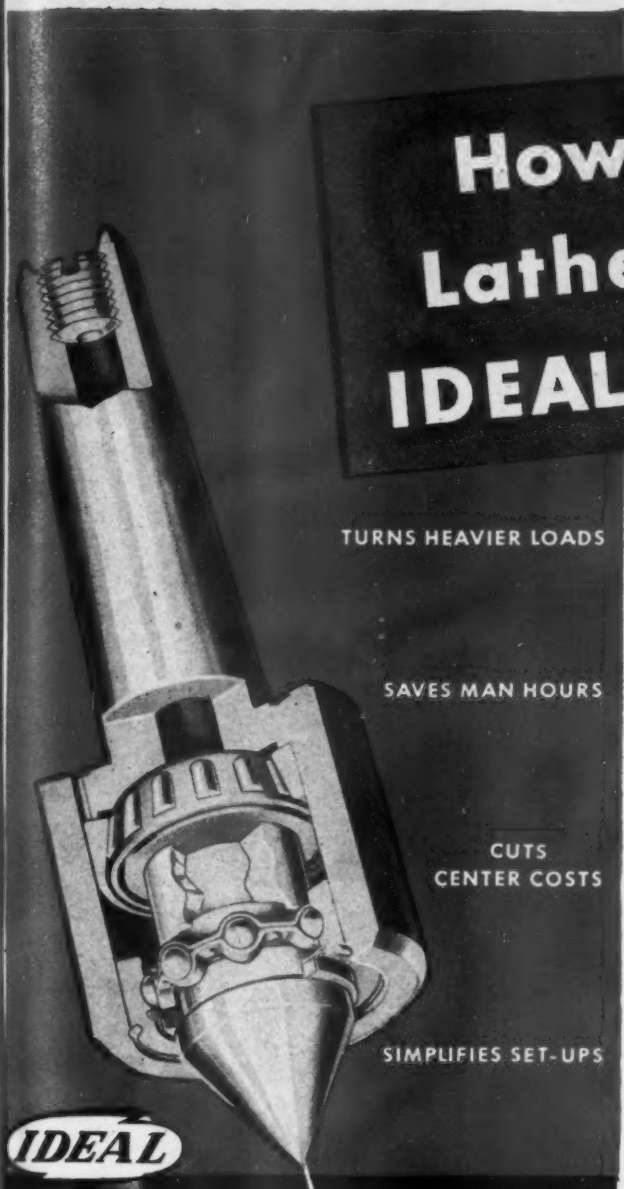
How to Increase Lathe Output with IDEAL LIVE CENTERS



1925

CUT COSTS . . . INCREASE PRODUCTION

Many shops report up to 100% increase in output after putting the TEAM of (1) IDEAL Live Centers and (2) Carbide-Tipped Tools to work on their lathes.

IDEAL Live Centers eliminate speed restrictions. With them, you can go the limit on speed of turning and depth of cut—which means practically as fast as the lathe can run.

IDEAL Live Centers turn with the work; no friction between the work and center, consequently no overheating; accuracy is maintained.

They simplify set-ups. Save man-hours in centering work—increase machine output.

Features of IDEAL Live Centers—

- High precision Ball and Roller Bearings.
- Precision workmanship assures accurate turning.
- All parts hardened and ground.
- Designed to withstand heaviest loads.

FOUR INTERCHANGEABLE INSERTS — IDEAL "Multi-Duty" Live Center has four interchangeable inserts for all centered and uncentered jobs. Sizes No. 1 to 5 Morse Taper.

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Accepted as Standard in Leading Tool Rooms and Machine Shops.

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Successor to Ideal Commutator Dresser Co.

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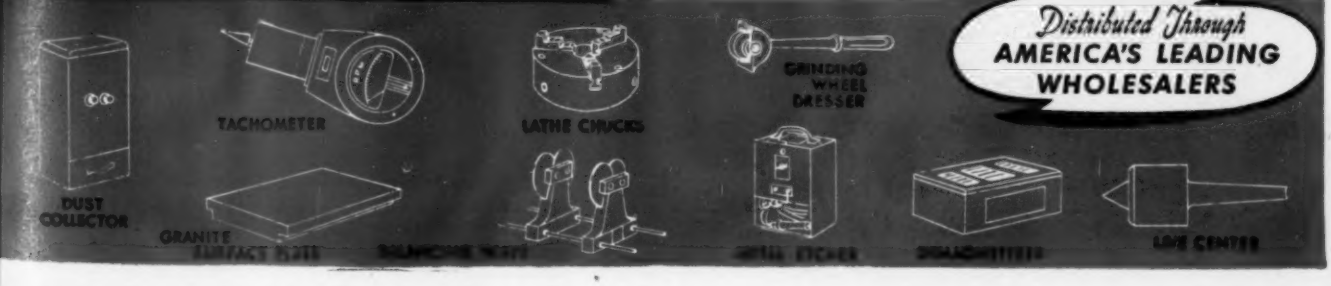

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BOEING AIRCRAFT CO., Seattle, Wash., one of America's great aircraft manufacturers, builds the famous Boeing B-29 and the forthcoming supertransport, the Boeing Stratocruiser. For superbombers and supertransports both, Boeing knows that the proof of SMITHway Electrodes is in production — and in service.

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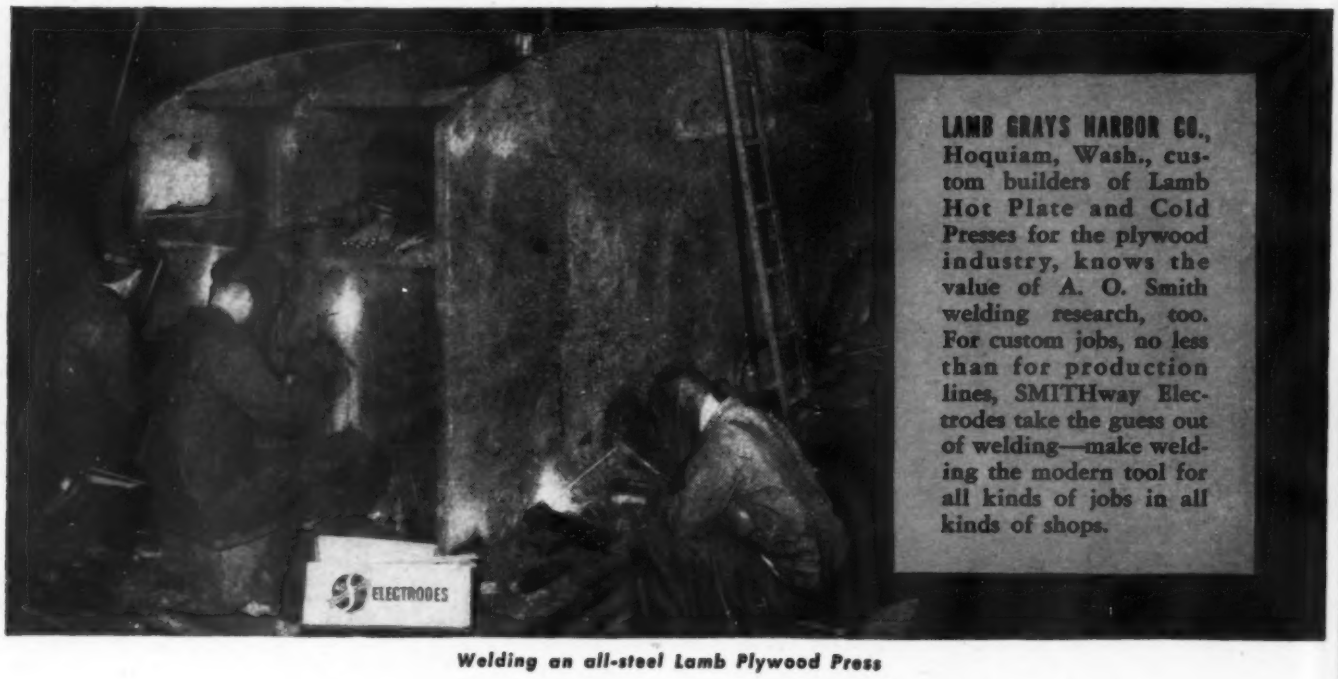
Both use SMITHway *Certified* Electrodes



LAMB GRAYS HARBOR CO., Hoquiam, Wash., custom builders of Lamb Hot Plate and Cold Presses for the plywood industry, knows the value of A. O. Smith welding research, too. For custom jobs, no less than for production lines, SMITHway Electrodes take the guess out of welding—make welding the modern tool for all kinds of jobs in all kinds of shops.

Welding an all-steel Lamb Plywood Press

SMITHway *Certified* Welding Electrodes — Made *by* Welders . . . *for* Welders

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Six models, including 3 new models of 150-, 200-, and 250-ampere capacity. Heavy-duty models: 300-, 400-, 500-ampere capacity. Write for specifications and prices.

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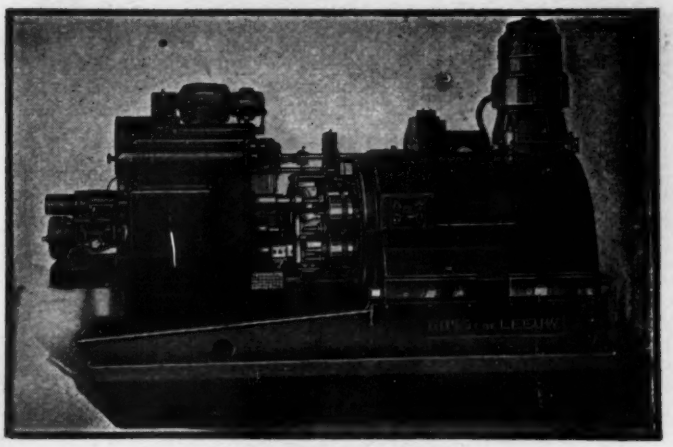
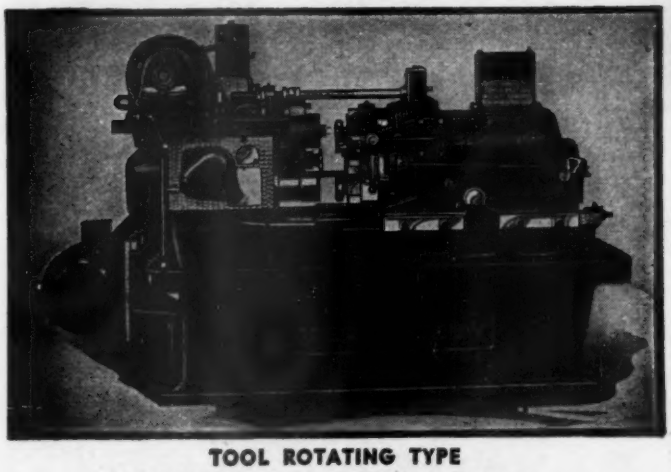
GOSS & DE LEEUW
Multiple Spindle
CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

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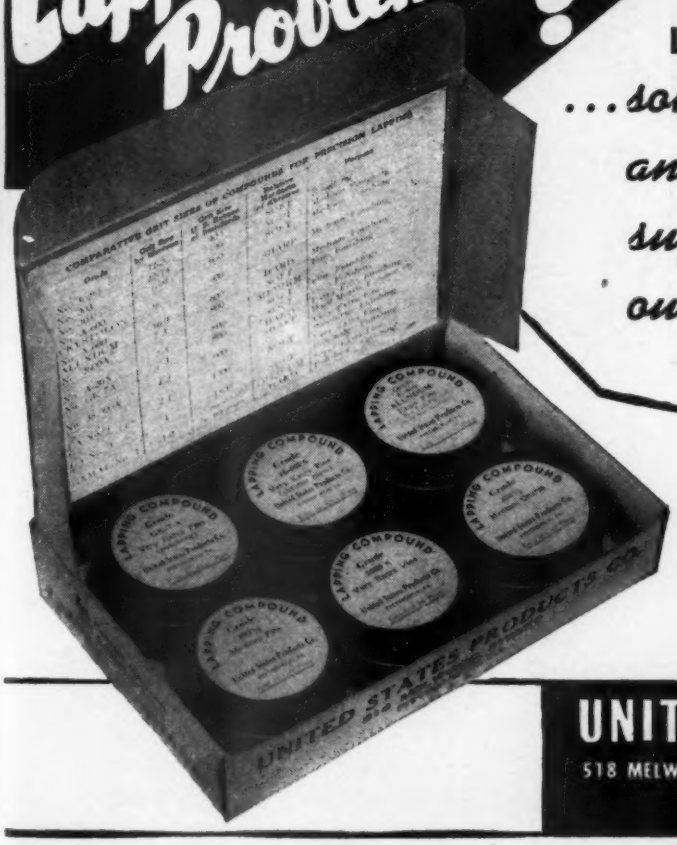
U. S. PRODUCTS CO.
LAPPING COMPOUNDS

...solve your problem and prove their superiority at our expense!



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The Blake Tap Grinder method of accurate chamfer sharpening enables you to keep your tapping machines running at the *optimum* speeds for the material and job, using the *most suitable* chamfer and clearance angles—to cut the *greatest* number of *accurate* holes per hour.

The increased production, the greatly reduced tap bills, the lessened spoilage, the use of less skilled tool crib labor, and other savings—direct and indirect—will result in your judging the purchase of this low-cost grinder one of your wisest investments.

The Blake is bench-size—fast, accurate, simple to operate, and versatile. It grinds *both* the chamfer angle and the relief—*of all the lands*—in *one continuous operation*. Men or women, with no special skill, can quickly learn to turn out perfectly sharpened taps—whether right- or left-hand, with 2, 3, 4, 5, 6, 8 or 10 flutes. Also countersinks, 3- and 4-flute drills and many other tools requiring relief on the point can be ground accurately and easily.

Send the coupon below for complete details.

No Machine is Better than the Cutting Edge of the Tool it Uses.

Please send me Bulletin 544 which gives complete details on Blake Tap Grinders. A.M.

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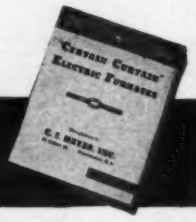
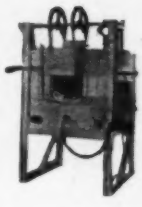
If you heat treat in controlled atmospheres you want this book



FULLY ILLUSTRATED DATA BOOK OF ATMOSPHERE HEAT TREATING AND CATALOG NO. 108



Having pioneered the first practical controlled-atmosphere furnace in 1926, "Certain Curtain" offers today 27 types applying the most advanced atmosphere control methods to hardening, copper brazing, annealing, sintering, tool tip brazing, etc. "The finest atmosphere control costs the lowest!"

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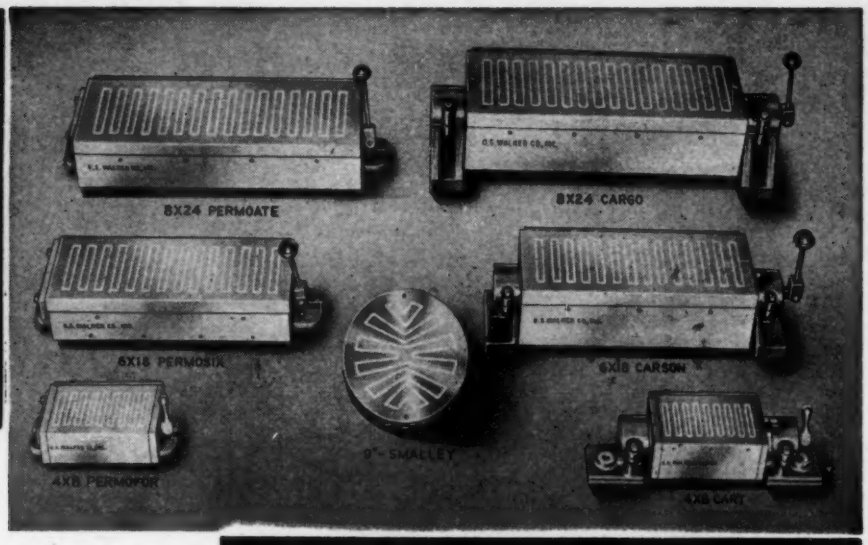

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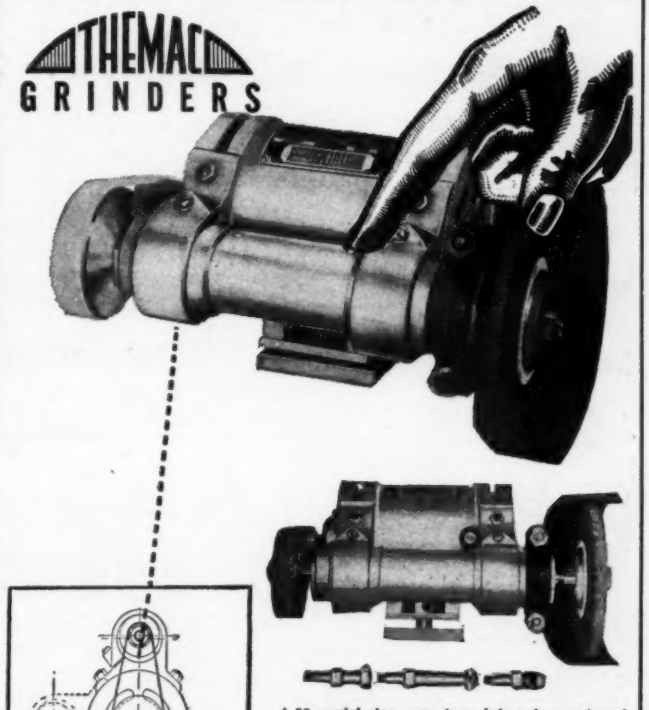
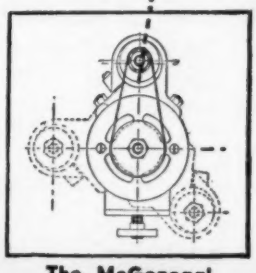
Original Producers of Grinding Lubricant

THEMAC GRINDERS





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J-35 model does any type internal or external grinding, on any size lathe. Its 3 interchangeable spindle extensions make this a tool of many uses.

Note the manually operated eccentric tube. This THEMAC feature provides proper belt tension.

Sketch on left shows the circumferential adjustment of Spindle Assemblies.

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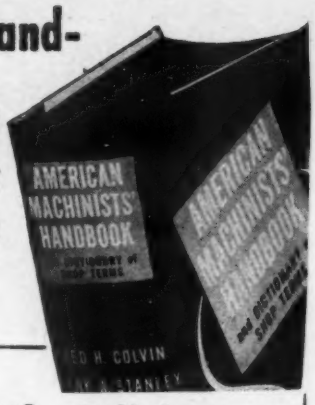

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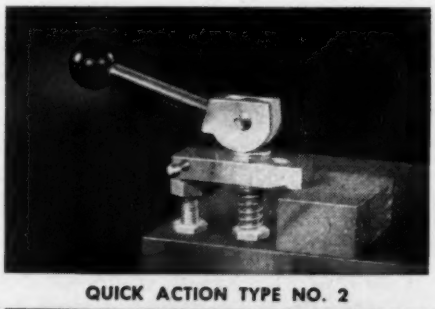

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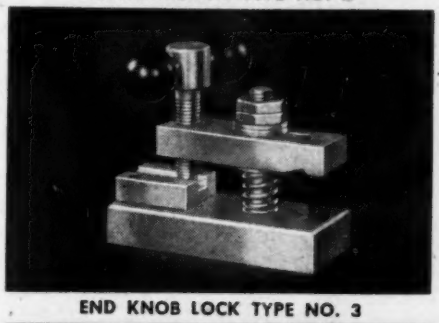

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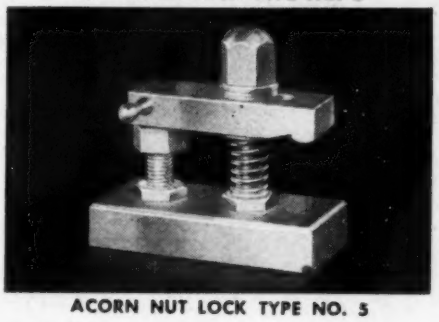

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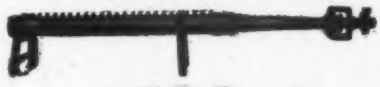

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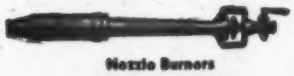

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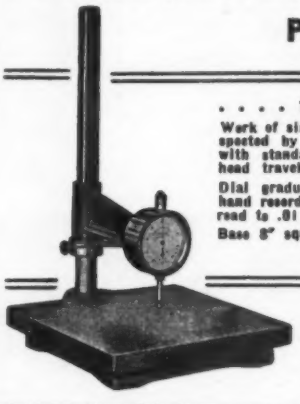

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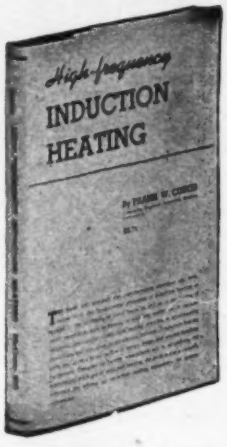

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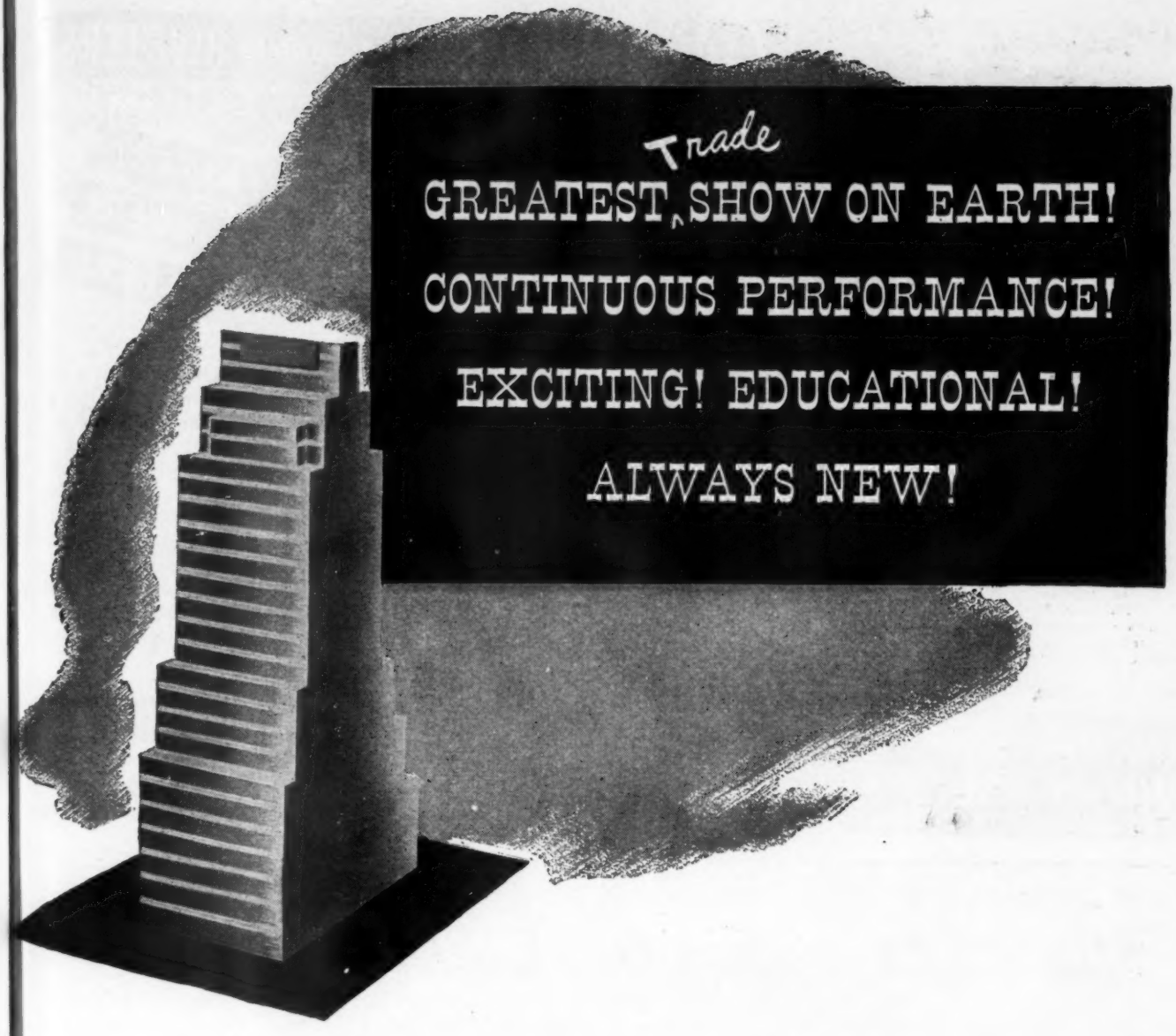

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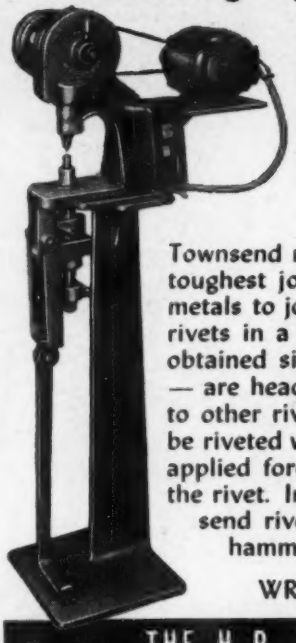

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Logan Q.C.G. Lathes (new).
Sebastian Engine Lathes (new).
1—LeBlond Heavy Pattern 24" x 12' 3-step cone Engine Lathe
13" x 6' Williard, geared head
14" x 6' Hendey Yoke Head
14" x 6' Rockford Cone drive (two)
14" x 20' Hendey Toolmakers Lathe.
16" x 6' American Motor Driven Lathe.
16" x 8' Lodge & Shipley 12-speed Grd. Hd.
18" x 6' Chard, M.D.
18" x 10' American, Geared Head, Taper.
18" x 222" Hendey, M.D. (two)
20" x 10' Hendey with Taper.
20" x 11' Schumacher-Boye, M.D.
24" x 20' American, Motor drive.
28" x 10' Davis cone driven
48" x 30' Simmons Geared Head, 1941.

TURRET LATHES

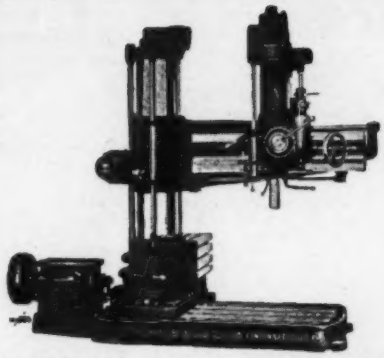
4—#4 Warner & Swasey Hand Screw Machines, arr. Motor Drive.
2—#4 Warner & Swasey Universal Turret Lathe, Motor Driven.
16" Warner & Swasey Brass Lathe.
#2A Warner & Swasey Universal.
#6A Potter & Johnson Automatic Chuckers.
#3R Gisholt Universal like new.
#4 Foster GFH Hand Turret Lathe.
3—Morey #2G Geared Head Turret Lathe, motor drive (late model)
2—Simmons #2 (microspeed) Turret Screw Machine (late model)
Bullard 42" Vertical Turret Lathe

TURRET PUNCHES

Hecker, vertical type, 8-station, air operated, 18" throat.

PLANERS

20" x 20" x 24" N.B.P., Planer Shaper.
26" x 26" x 8' Gray Planer, 2 heads.



SHEARS & METAL WORKING

Lennox Splitting Shear ¾" cap.; 8' throat.
Lennox Bevel Shear, ¾" cap.
Peckstow 30" x 18 ga. Squaring Shear.
Gould & Eberhardt Slitting Shear, 10 ga.
Niagara 48" Roller Leveller, 6 Rolls.

MILLING MACHINES

#3, #4, #5 Cinn. High Power, Plain, S.P.D.
#1-#1½-#2 Brown & Sharpe Plain Miller.
P & W 2½" Duplex Spline Miller.
Thread Miller, Hall Planetary #1—24".
#8 Lees Bradner Thread Miller.
#1, #2 Kempsmith Plain Millers.
#3B Hendey Universal Miller, motor drive.
#4 Cinn. Vertical High Power Miller. (2).

2—#16 Blanchard Surface Grinder, 30" dia., magnetic chuck, 25 h.p. motor on spindle.
2—#2 Cincinnati Centerless Grinder.
Pratt & Whitney Vertical Surface Grinder, 14" x 36" with 10" x 36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.
#2 Cincinnati Universal Tool and Cutter.

RADIAL DRILLS

4' Arm, 11" Column Cincinnati-Bickford.
5' Arm, 13" Column Cincinnati-Bickford.
5' Arm, 14" Column Fosdick, motor drive.
6' Arm, 15" Column Cincinnati-Bickford.
3½', 10" Col., Cincinnati-Bickford AC Motor Drive, Gear Box.
Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

GRINDERS

Queen City Dble. End Grinders, motor driven (new).
#33 Abrasive Vertical Surface.
#3 Abrasive Horizontal Surface.
12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
1—Gardner Dble. Opposed Grinder #14
1—Seybold 96" Knife Grinder
Oliver of Adrian Drill Grinders
Cincinnati Centerless Grinders #2 M.D.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole; 4" deep.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
10" x 18" Norton Cylindrical.
2—Cincinnati, #1½ Tool & Cutter Grinders.

BORING MILLS

72" Cincinnati Heavy Pattern Vertical Boring and Turning Mill.
3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
#31 Lucas Horizontal Boring Mill, 3" bar.

DRILLING MACHINES

Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.
2—Natco #14, 22 spindle Rectangular head Drilling Machine, #2 M. T.

POWER PRESS HEADQUARTERS

Famco Arbor & Foot Presses (new).
#4 Bliss D. C. Forging Press.
200 ton A.C.F. Hydraulic Press. Bed. 24" x 36", 4-post.
75 ton H.P.M. 2 post, Hydraulic Press.
Hilles & Jones #4 Single End Punch and Shear. Equipped as Plate Shear with 18" Blades. ARR, motor drive, 54" throat.
1—Leland-Gifford 6-spdle. Drill Press (late model) ind. spdle. motors.

SHAPERS & GEAR CUTTERS

1—Whipp 16" B. G. Crank Shaper.
1—Fellows #6—36" Gear Shaper.
Barber-Colman Gear Hobbers #2, #3.
1—Brown & Sharpe #3—26" Automatic Gear Cutter.
#1 Adams Gear Hobbers, Belt driven (2).
24" American Direct Motor Drive.
Slotter 12" stroke New Haven, motor drive.
2—#0 Jolt Squeezer Draw Pattern serial #58382197, #58382196
2—#42 Osborn Rockover and Draw Machines, 14" x 20½" table
3—#342 Osborn Jolt Rollover Pattern Draw Moulding Machines
2—Hand Rollover Power Draw Moulding machines complete with Run-out cars

MISCELLANEOUS

15 KVA Ace Spot Welder, 18" throat, 1/60/440 volt.

Approved Dealer War Assets N. Y. 47

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QUALITY *Machine Tools*
NOW IN STOCK

No. 35 Excello Thread Grinder, Motor driven, with wheel thinning attachment, refrigerated coolant equipment. New in 1943.

1⅝" Cone Eight Spindle Automatic Screw Machine, with threading spindle, chip conveyor, miscellaneous collets and feed fingers, motor driven. New in 1942.

AUTOMATICS
5¼" Cleveland Model A, single spindle.
16" x 33" Fay Automatic Lathe.
⅞" Cleveland Model M, four spindle.

DRILLS
★ **4 Ft. American Hole Wizard Radial Drill, motor on arm, new in 1940.**
No. D2 Colburn, single spindle.
42" Cincinnati Bickford.
Allen Sensitive Drill, four spindle.
★ **No. 3 Bausch Multiple, 20 Spindle, No. 2 Morse Taper, Rectang. Head 20" x 40".**
Pratt & Whitney Gun Barrel Drill.
LeBlond Gun Barrel Drill.

GEAR CUTTERS
No. 3 and No. 12 Barber Colman Gear Hobbers.
No. 6, 61 Fellows Gear Shaper, m.d.
6" Gleason Str. Bevel Gear Generator.

GRINDERS
36" x 168" Mattison Surface Grinder.
No. 22 Heald Rotary Surface Grinder.
No. 16-26" Blanchard Surface Grinder.
No. 72A3 Heald Sizematic Int. Grinder.
No. 72A3 Heald Gagematic Int. Grinder.
No. 70 and 75 Heald Internal Grinders.
10" x 24" Norton Cylindrical Grinder.
10" x 72" Norton Cylindrical Grinder.
10" x 24" Thompson Hyd. Surface Grind.
No. 2 Cincinnati Centerless Grinder.
★ **No. 3 Cincinnati Centerless Grinder.**

JIG BORING MACHINES
★ **No. 2A Pratt & Whitney, with 22" x 44" Table, 24" rotary table, locating device, inside micrometer, measuring rods, etc. New in 1944.**

LATHES, ENGINE
★ **12" x 30" Monarch Model KK.**
14" x 6' Sebastian, motor in base.
16"x6' Hendey, g.h.
20" x 12' Lodge & Shipley, g.h.
48" x 12' Lodge & Shipley, C.D.
No. 12 Gisholt Hyd. Lathe.
LR Lo-Swing Lathe, m.d., new in 1940.
15" x 30" Lipe Carbo-matic, new in 1943.

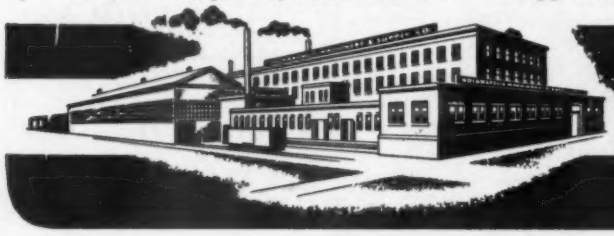
LATHES, TURRET
No. 3A Warner & Swasey, g.h.
No. 2A Warner & Swasey, Timken Bearing, new 1942.
No. 1A Warner & Swasey, g.h., new 1943.
No. 1B Foster, g.h.
No. 4 Warner & Swasey, g.h., new in 1942.
No. 3 Warner & Swasey, g.h., new in 1943.
No. 1 Bardons & Oliver, c.d.
No. 1 Brown & Sharpe, m.d.
No. 6D Potter & Johnston Automatic Chucking and Turning Machine.

MILLS
No. 31 Lucas Horizontal Bor'g Mill, m.d.
No. 36 Van Norman Horizontal, m.d.
No. 4A Brown & Sharpe Universal, s.p.d.
No. 3 Cincinnati Universal, s.p.d.
No. 4 Cin. Plain, Rect. Overarm.
No. 2H Milwaukee Plain double overarm, motor in base.
No. 2-MH Cincinnati Plain, m.d.
★ **No. 4H Milwaukee, Double Overarm, motor in base, new 1940.**
No. 2H Milwaukee Vert., motor in base.
18" Cincinnati Plain Mfg.
No. 2209 Milwaukee, Table 22" x 158".
No. 3-36 Cinci. Hydromatic Duplex, m.d.
No. 6 Whitney Hand Mill.
4" Pratt & Whitney Spline Mill.

MISCELLANEOUS
No. 17 Greenerd Arbor Press.
No. 100 Micromatic Hydrohoner.
8" x 7" Troy Vertical Steam Engine.

PLANERS AND SHAPERS
★ **12" Hendey Crank Shaper, motor driven, 16" Ohio Crank Shaper, c.d.**
28" Gould & Eberhardt Crank Shaper.
★ **6" Pratt & Whitney Vertical Shaper.**
42" x 42" x 20' Cin. Planer, D.C. Rev. m.d.

(Approved Dealer for War Assets Administration Surplus Machines)



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1961 S. Meridian St., Indianapolis 6, Indiana
EASTERN BRANCH: 44 WHITEHALL ST., NEW YORK
MEXICO OFFICE: Avenida Independencia No. 36B, MEXICO, D. F.

AUTOMATICS—Swiss, Gorton 16A—5 slide 7/16" cap, all attachments 1944
Swiss, Ceco—5 slide ½" cap, all attachments 1944
BRAKES—Press, Geo. Ohl, 10½' x 10 Gauge, motorized
D&K, apron type, 8' x 16 g, power
GRINDER—Centerless, Zephyr #2M (1945)
HAMMERS—Board Drop, Billings & Spencer, 1400 lb.
Board Drop, Billings & Spencer, 1600 lb.
JIG BORER—Sip, Swiss MP 3C—like new
LIFT TRUCK—Electric—2 ton—platform 38" x 54" with charger
LATHES—Engine Le Blonde 21" x 10' Q. C.
(2) Engine Monarchs 16" x 8' motor in base taper. Oliver 18" x 6' Q. C., motorized

POWER PRESSES
Air Hydraulics—2½ ton cap. New

	MAKE	TONS	DIE SPACE	STROKE	SHUT	TYPE
(20)	V & O #0	5	13" x 12"	2½"	7"	OBI Dial feed
(20)	V & O #2	17	12" x 18"	2½"	11"	OBI Dial feed
(22)	Hercules #32 (about)	15	10" x 14½"	3"		"C" Frame Hopper feed
(23)	Wat Farrel (about)	15	12" x 18"	3"		"C" Frame Dial feed
	Bliss #172A	22	5" x 4"	1½"	7"	End Wheel
	Bliss #68C	35	21" x 10½"	1-2½"	7"	Arch-DA
	Adriance #155	40	29" x 36"	1½"	10"	OBI-SA
	Torrington	40	23" x 16"	1-2"	6¼"	SS-DA
	Bliss #1B	43	14" x 26"	3-6"	8½"	SS-DA, Gap
(2)	Bliss #52	45	14" x 15"	2"	9½"	SS-DA
(2)	Consolidated #54	60	18" x 18"	3"	12"	Trimmers-Shear
	Bliss #57	75	18" x 18"	2"	11"	SS Trimming
	Bliss #4½	75	21" x 26"	1½"-4½"	18"	SS-DA, Geared
(2)	Bliss #7	180	28" x 36"	1½"-4½"	15"	SS-DA, Geared, Air Clutch
	Toledo #59½5	500	31" x 31"	8"	29"	SS-SA, Twin drive
(3)	Mystic #5A	40	14" x 17"	6"	14"	Embossing & Moulding for Plastics

RIVET COUNTERSINKING MILL—Farnham 36" reach
SAWS—Kalamazoo metal cutting, new
SHEARS—Bliss 42" x 3/16", Squaring, power, gauges. Bliss 24" x 3/16", power, gauges
(8) TURRETS—Denver 6" motor in base air chuck, late

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MDNA MEMBER

Lathe, 12"x5' Hendey Tool Room Lathe, Q.C.G., with tiebar, taper attachment, 3 and 4-jaw chucks, collets, pan bed, B.D.
Lathe, 12"x5' Monarch 8-speed, all geared head, S.P.D., Q.C.G.
Lathe, 18"x8' Lodge & Shipley D.B.G., cone head, B.D.
Lathe, 18"x8' Greaves & Klusman, all geared head, taper att., M.D.
Lathe, 36"x16' Boye & Emmes, triple geared head, M.D.
Automatics, Model 2—6A Potter & Johnston, M.D. (3)
Screw Machines, No. 4 W. & S. Friction head, power feed to turret automatic chuck and bar feed, B.D.
Turret Lathe, No. 2-A W. & S. Univ., S.P.D., chuck work
Milling Machine, No. 1 Kempsmith Univ., B.D.
Milling Machine, No. 3 Kempsmith Plain, D.B.G., B.D.
Milling Machine, No. 56-90 Cincinnati Hydromatic, working sur. of table 24"x108", M.D.
Milling Machine, Ingersoll Planer Type, table 30"x10', one rail head, two side heads, M.D.
Drills, No. 30 Natco Multiple Spindle, recti. hds., geared feeds, 32, 34 and 42 spindles (5)
Drill, 4' Hammond High Speed Sens. Radial, Model B, tapping att., M.D.
Drill, 8'-16" American Triple Purpose Radial, box table, motor on arm
Drill, Moline Hole Hog, 6-Spdl., B.D.
Broach, No. 3 LaPointe, M.D.
Gear Hobber, No. 12 Barber-Colman
Bolt Cutter, 1" Landis Single Head
Planer, 60"x48"x20' Cincinnati, 4 hds., M.D.
Boring Mill, 100" Betts, two swivel heads, side head
Grinder, No. 72 Heald Int., hyd. feeds

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Available for Prompt Shipment — Nearly All Built After 1941

AUTOMATIC SCREW MACHINES
CLEVELAND ⅜" to 2½" Model A
CONOMATIC 3½" 4 spindle—latest type
NATIONAL ACME 9/16" mod. C, 5 spdle., M.D.

BORING MILLS—Horizontal
FRANKLIN 4½" bar, single pulley drive
GIDDINGS & LEWIS #25, 2⅜" bar, M.D.
LUCAS #31—3" bar—motor drive
NILES BEMENT POND 5½" bar—M.D.
NILES BEMENT POND 4½" bar—floor type—M.D.
NILES-BEMENT-POND 5", 6", 7" bar—floor type—M.D.
OHIO #5F-420 5" bar Floor type, latest type
P & H #10—3½" bar—floor type—M.D.
PETRICK 3½" bar, floor type, M.D.

BORING MILLS—Vertical
BETTS 120"—2 swivel heads, motor drive
BULLARD 24", 36", 42" New Era Type M.D.
BULLARD 86"—2 swivel heads—motor drive
COLBURN 72' 2 swivel heads, AC, M.D.
KING 30" Vert., M.D.
KING 72" 3 heads, AC, M.D., Latest type
KING 62" 2 swivel heads, PRT, AC, M.D.
NILES 42"—2 swivel heads; power rapid traverse
NILES 73"; 2 swivel heads; AC; M.D.
NILES BEMENT POND—100" two swivel heads, PRT Motor Drive

DRILLS
BAKER #121 Single spindle—latest type
BARNES #H3, Hydram, latest type
BAUSH #2, #3, Multiple spindle, M.D.
BODINE #42-20, 42-30 auto, M.D.
COLBURN #14, 2 spindle, heavy duty, AC, M.D.
EDLUND No. 1B, single spindle, M.D.
EDLUND No. 2MS, 2 spindle, M.D.
FOOTE BURT SIPP #2, #3—single spindle—latest
HENRY & WRIGHT 2 spindle
NATCO C-13H multiple spindle
PRATT & WHITNEY No. ½Bx50" 2 spdle. Deep Hole—latest type

DRILLS—RADIAL
AMERICAN 4'11", 5'13" triple purpose, M.D.
AMERICAN 4'11", 5'11", 5'13" triple geared, AC, M.D.
BICKFORD 4'11", 5'11", 5'13", AC., M.D.
CANEDY OTTO 3'11" New
CARLTON 3'11", 6'17", latest type
CARLTON 4'13", 5'14", 6'15", M.D.
CINCINNATI BICKFORD 4'11", 5'13", plain, M.D.
CINCINNATI BICKFORD 6'19", Super Service, M.D., latest type
DRESES 4'13", 5'15", AC, M.D.
FOSDICK 5'14" AC, M.D.
MORRIS 3½'9", 4'11" AC, M.D.
MUELLER 4'11", 4½'9", AC, M.D.
NILES BEMENT POND 6'15" uni., AC, M.D.
REED PRENTICE 4', 6', AC, M.D.
RYERSON 4'11" AC, M.D.
WESTERN 3' single pulley drive
WESTERN 4'18"; 5'18"; 6'20"—latest type

GEAR CUTTING EQUIPMENT
BARBER COLMAN Type S hobber, latest type
BARBER COLMAN No. 3 Gear Hobber
BARBER COLMAN #12 hobber, M.D.
BROWN & SHARPE #3H gear cutter, M.D.
FELLOWS #7, #7A, 72, 77 gear shaper
FELLOWS #7125A, 75A, latest type
GLEASON #13 tester, M.D.
GLEASON 24" Bevel Gear Planer
GLEASON 18" bevel gear generator
GOULD & EBERHARDT 18H, Uni. hobber, M.D.
G & E #96H Gear Hobber, with differential

GRINDERS—Cylindrical—Plain & Univ.
BROWN & SHARPE #1, #3, #4, Uni., M.D. latest type
BROWN & SHARPE #5 Plain 3x12 latest type
LANDIS 6x20 6x18 Plain—motor drive
LANDIS 6x30 Plain Type "C", Hyd. latest
LANDIS 12x36 Universal Type LC Hydraulic; latest
NORTON 10x18 plain, M.D.
NORTON 14x48 Univ. Type C Multi-purpose HYD., latest type

GRINDERS—Internal, Cutter and Misc.
BROWN & SHARPE #13, Uni., and tool, M.D.
BRYANT No. 16—16" Chucking—Internal—latest
BRYANT #5 internal, hyd., latest type
FITCHBURG Uni. spline shaft, hyd.
GLEASON #12 cutter grinder
HEALD 72A3 Sizematic Internal, latest type
HEALD 72A5 Plain internal dial type, latest type
LEBLOND #2 uni., tool and cutter, latest type
PRATT & WHITNEY Contour Cutter—latest type
SELLERS #4T Univ. tool—latest type

GRINDERS—Surface
ABRASIVE #3 22x8x12, M.D.
ARTER, 8" Rotary Surface
ARTER 30" Rotary Surface—Hydraulic—latest
ARTER Automatic Piston Ring
BLANCHARD #16A—Dial Type—motor drive
BLANCHARD #16—26" Chuck—motor drive
MATTISON 16x24x96—Hydraulic—latest type

LATHES—Engine & Mfg.
AXELSON 24"x72" centers—Timken—latest
BRIDGEFORD 36"x28', 36"x32', 36"x35', 42x35', bed—2 carriages
HENDEY—12x54 centers—Mfg.—latest type
LEBLOND 13"x4' bed—Timken—Mfg.—latest
LEBLOND 17"x14' bed, Mfg., Timken—latest
LEBLOND 20"x48', centers—Timken Mfg., latest
LOSWING 4x34, 4x60, 8x34, 8x108, 8x60—Timken Bearing—latest type
LOSWING 10x34 Model LR Auto., Timken, latest
NILES 36"x25 centers, 2 carriages; PRT; Timken Bearing, latest type
PITTSBURGH 50'x30' bed—M.D.

LATHES—Turret
BARDONS & OLIVER #3 latest type
BARDONS & OLIVER No. 5, No. 7 Univ., Timken Bearing, chucking; latest type
BROWN & SHARPE #1 Hand screw machine, Timken bearing—latest type
CINCINNATI ACME #5W—Timken Bearing—latest type—2" Bar Cap.
CINCINNATI ACME #1 Uni.—Timken—latest
GISHOLT #3, #4 Univ. Timken Bearing—latest
GISHOLT #3D Simplimatics—Timken—latest
GISHOLT #4L, 9" hole—cross sliding Turret—Timken Bearing—latest type
GISHOLT #1L, #2L, uni. Timken bearing, latest
JONES & LAMSON #3, #5, #7C Univ.; latest type—Timken Bearing
LIBBY #1H-5 Timken Bearing—latest 5½" hole
MOREY #2G, 1" cap.—Timken Bearing
MOREY #3 Univ. 1½" Cap.—Timken Bearing
MOREY #4 Univ.; 2 cap., Timken Bearing
WARNER & SWASEY #3, #4, #5, Univ., Timken Bearing—latest type
WARNER & SWASEY No. 1A, 3A, 4A, Univ., Timken M.D.

MILLING MACHINES—Manufacturing
BRIGGS Type 2A Production, Hydraulic, latest type
BROWN & SHARPE #12 auto., Timken, latest
CINCINNATI 4-36 Hydro. Timken Bearing—latest
CINCINNATI #08 Vert.—Pl. Auto.—Timken Bearing—latest type—Rise & Fall
CINCINNATI #1-12, #1-18 Plain Auto.—Timken Bearing, latest type
CINCINNATI 48" duplex, automatic, SPD
KEARNEY & TRECKER #121B Auto.—Timken Bearing—latest type
MOREY #12M 2 spdle Profiler & Milling Machine
NICHOLS hand, M.D.—latest type
OHIO Auto. 16"x72" table—Timken Bearing—latest type—36" longitudinal feed

MILLING MACHINES—Plain
CINCINNATI #4S High power, motor in base
CINCINNATI #5 high powered, M.D.
KEARNEY & TRECKER #3K, Timken, latest
KEMPSMITH #4 Maximiller—Timken latest

MILLING MACHINES—Universal
AMES Bench, Timken Bearing, latest type, M.D. 1" collet.
BROWN & SHARPE #3A Timken Bearing—dual control—latest type
ROCKFORD #2B—motorized

MILLING MACHINES—Vertical
BROWN & SHARPE #5—motor drive
CINCINNATI #2, #4—Dial Type—Timken Bearing—latest type
COCHRANE BLY Uni. Vert. Shaper-Miller; M.D.
KEARNEY & TRECKER #3K, Timken, latest

PLANERS
BELMAR 36x36x10' 2 heads, AC, M.D.
BELMAR 48x48x12' 3 heads, AC, M.D.
BICKETT 36x36x12' 3 heads, AC, M.D.
CHANDLER 36x36x20', 4 heads, AC, M.D.
CINCINNATI 24" Crank—motor drive
CINCINNATI 36x36x5' Box Table, PRT, 1 head—motor drive
CINCINNATI 48x48x20', 3 heads, AC, M.D.
CINCINNATI 120x96x20'—4 heads, box table—PRT—motor drive
CINCINNATI 36x36x8', 2 heads, AC, M.D.
CINCINNATI 42x36x12', 2 heads, AC, M.D.
CINCINNATI 60x48x14' 4 heads, AC, M.D.
CLEVELAND 48x48x16' Opensides 3 heads, M.D.
DETRICK & HARVEY 48x48x10', 12' open side, 3 heads, M.D.
DETRICK & HARVEY 48x48x16' 4 heads, Hyd., M.D.
GRAY 44x36x12', 4 heads, AC, M.D.
GRAY 48x48x14', 4 heads, AC, M.D.
GRAY 54x42x10', 2 heads, AC, M.D.
GRAY 60x48x16', 3 heads, AC, M.D.
HAMILTON 42x42x20', 4 heads, motor drive
HAMILTON 48x48x16', 4 heads, DC, M.D.
LIBERTY 36x36x9', 3 heads, AC, M.D.
LYND FARQUHAR 26" Openside, motor drive
NBP 36x36x10', 3 heads, DC, M.D.
NBP 42x42x12', 2 heads, AC, M.D.
NBP 48x48x14', 16', 2-4 heads, AC, M.D.
NBP 54x54x12', 2 heads, box table, AC, M.D.
NILES 48x48x12' Time Saver, 3 heads, power rapid traverse, box table, DC, M.D., latest type
NILES BEMENT POND 96x80x20' box table 4 heads Hyd. PRT—motor drive
OHIO 36x36x10', 2 heads, AC, M.D.
OHIO 42"x42"x20', 2 heads, AC, M.D.
PATCH 48x48x14', 4 heads, DC, M.D.
POND 42x42x12', 2 heads, AC, M.D.
POND 48x48x16', 2 heads, AC, M.D.
PUTNAM 48x48x18', 4 heads, AC, M.D.
WOODWARD & POWELL 36x36x12', 4 heads, AC, M.D.
WOODWARD & POWELL 42x42x10', 4 heads, AC, M.D.
WOODWARD & POWELL 84x48x18', 2 heads, AC, M.D.

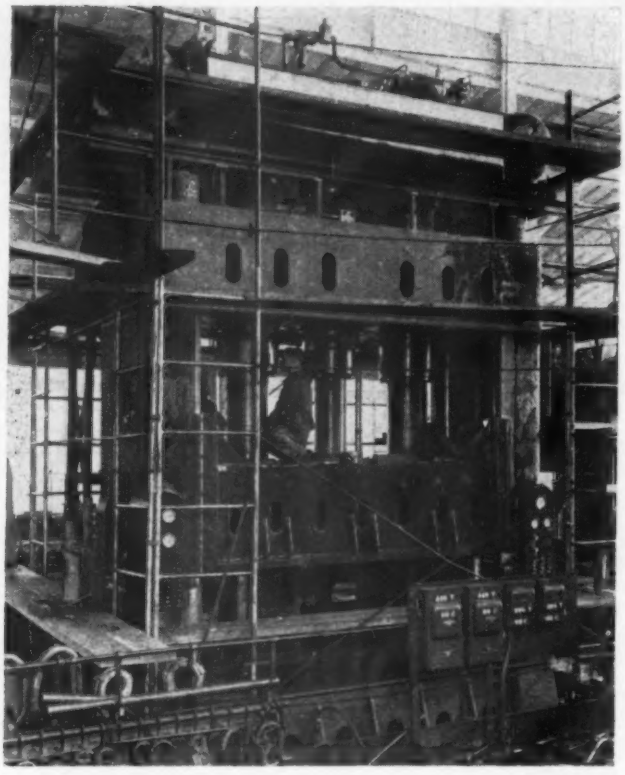
SAWS
BRIDGEPORT #48W Abrasive
CAMPBELL No. 213 Wet Abrasive Cutoff, latest
CAMPBELL #401 Cutamatic Wet Abrasive—latest
GROB #OS-20 band, latest type
LUCAS #138 cold saw, motor driven
MAQUOKETA 10x10 hack, M.D.
MARVEL #9, 10x10 Hack; latest type
MOTCH & MERRYWEATHER #3 Cold Saw—Hyd.—latest type
PEERLESS 14x14 Hack; latest type

SHAPERS
BETTS 18" vert, slotter, DC, M.D.
CINCINNATI 28" horiz. double head
COCHRANE BLY Uni. Vert. Shaper-Miller; M.D.
JONES 6" Vertical—latest type
LAMAIRE 18" Vert. Hydraulic—latest type
MOREY 10", 14" Vertical—latest type
NEWTON 15" vert. slotter, DC, M.D.
NILES 18" vert. slotter, DC, M.D.
PRATT & WHITNEY 6", 10" Vertical, Motor drive

THREAD MILLING MACHINES
MOREY SHIELDS 12x120, 12x192—latest type
PRATT & WHITNEY 4½x12, 6x20, Model C—latest
PRATT WHITNEY 6x132—motor drive

MISCELLANEOUS
BARNES #2 SS Hone—latest type
BILLINGS & SPENCER 200, 400, 800 lbs. Board drop hammer
COLONIAL Model HAS-25-72 Universal, Broach, horizontal, hyd., 25 ton cap.
FERRACUTE No. DG-55 Drawing—latest type
FISHER #1 Oil Groover, M.D.
LEBLOND #2 Horiz. Hone—SS
LEBLOND #2 Deep Hole Borer; latest type
MORTON 60" Combination Traveling head Planer, Milling & Drilling
NILES 30"x50' Deep Hole Borer, Timken latest
PRATT & WHITNEY #3B Jig Borer, latest type
WHITON 8x108 Duplex Centering, M.D.
YODER Mult. Tube Cutting Machine

MOREY MACHINERY CO., INC.
410 BROOME ST., NEW YORK 13, N. Y.
TELEPHONE: CANAL 6-5360
CABLE ADDRESS: WOODWORK, N. Y.



HYDRAULIC PRESSES

One brand new 1000 ton Lake Erie single action hydraulic press with cushion in bed and 220 V. 60 cy. 3 ph. electrical equipment. Between housings 140", bed size 60" x 144", capacity of cushion ram 140 tons, stroke of main ram 36", stroke of cushion ram 24". Shut height above bolster 36". Hole thrubed 40" x 132¼", shut height above bolster 36". Speed of operation 1250" per minute, rapid traverse closing, 295" per minute, low pressure pressing up to 300 tons, 87.5" per minute high pressure pressing at 1000 tons, 1050" per minute rapid tranverse return. *Delivery in the month of November.*

1—500 ton Southwark single acting high speed hydraulic press, bed 42" F to B, by 54" R to L. Distance between uprights 54". Stroke 20". Shut height bed to ram 24". Hole in bed 26" F to B by 40" R to L with 75 HP 220 or 440 V. 60 cy. 3 ph. motor. *Delivery immediate.*

MILES MACHINERY CO.
SAGINAW, MICHIGAN

UNUSUAL VALUES

Blueprint machines, printer-washer-dryer
Rivett Ball Brg. Precision Screw-Machine
Simmons No. 1A Micro Milling Machine
Drills, high speed single & multiple spindle
Drill, 21" Royersford Bk. Grd. Pr. Feed, New
Drills, sensitive, 2 and 4 Spindle
Drill, #25 Foot-Burt, motor driven
Drills—New—18" Royal Motor driven (10)
Gear cutter, Brown & Sharpe #3—26
Gear cutter, Gould & Eberhardt 12"
Grinder, Webster and Perks #1-¾ motor drive
22" Buffalo Pr. Fd. Motor Drive, New
16"x6' Hendey Lathe, Quick Change Gear
Magic Chucks #1-2 & 3 and Collets
Pipe Machine, 3" Oster motor drive
Planer 24"x24"x6' Pease, motor drive
Punch & Shear, two ½" & ⅝" capacity
Shaper, 24" Gould & Eberhardt
Turret Lathe, 2" Acme & Warner & Swasey
Welders—Arc & Spot in Stock—New

Outfit: about 27 fine machine tools, drills, lathe, and 5 milling machines, plain and Uni. Tell us definitely what you want as our list is incomplete and only partial.

The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

STOCK TOOLS

PROMPT SHIPMENT

BOR. MILLS, 2½" bar, Cleveland, M.D.
BORING MILLS, 3" and 4½" bar Universal.
BORING MILL, Hor. 4" Lanais, Floor Type.
BOR. MILL, 56" Bullard, "New Era"
BOR. MILL, 36"-44" N-B-P, Tur. & Side Hds.
BOR. MILL, 42" King, Tur. & Side Hds.
BOR. MILL, 60" N-B-P, 2 heads, M.D.
BROACH, Hr. Hyd. X4 Oilgear, 60" stroke.
BROACH, Vert. Hyd. SRV5-42" LaPointe.
GRINDER, Internal, No. 72A5 Heald, 2 Mtr.
GRINDER, Plain, 14"x72" Norton, M.D.
GRINDER, Rot. Surf., No. 25 Heald, M.D.
GRINDER, Surf., No. 2 Diamond, 16x36
GRINDER, Surf. No. 16 Blanchard, M.D.
HAMMER, Beard Drop, 1,000#, B & S.
HAMMERS, Steam Drop, 5,000#, & 12,000#.
LATHE, 24"x16' B & E, Grd. Hd., Q.C.G.
LATHE, 36"x22' N-B-P, Grd. Hd., Q.C.G.
LATHE, 32"x19' Putnam, Grd. Hd., Q.C.G., T.A.
LATHE, Turret 6W Acme, 3" h.s., Mtr. in base.
LAPPER, No. 1 Micromatic Hone (New)
MILLER, Duplex 24" Cincinnati Auto.
MILLER, Plain, Nos. 3S, 4 & 5 Cincinnati.
SHAPERS, 24" Cincinnati, 24" American
SHAPER, Vert. 10" Pratt & Whitney.

LANG MACHINERY COMPANY
28th St. & A.V.R.R., Pittsburgh, Pa.

AUTOMATICS

Gridley, 2⅝" Model RA., 4-spdl., motor 3/60.
Cone, 1⅞" Plain Bearing, 8-spdls., MD. (2)
Gridley, 1¼" Model C., 4-spdl. with motor.

LATHE

9" Hendey Gaugemaker's motor in base, TA., Oil Pan, Cabinet Base, Dial Speed Control, Collets, Bar Attachment & Chuck.

MILLING MACHINES

Van Norman #2-SU. Universal with 5 HP. Motor of 3/60/220 V. New 1940. (2).

GALBREATH MACHINERY CO.
Empire Building Pittsburgh, Pa.

Cincinnati 8"x18" Plain Grinder, M.D.
Hardinge 9" Toolmaker's Lathe
Rockford 14"x6' Lathe

D. E. DONY MACHINERY CO.
47 Laurelton Road, Rochester 9, N.Y.

THREAD GAGES—PLUG AND RING

Slightly used, NF-2 & 3, ¼ to 1", 6, 8, 10 M.S. Also 1 to 4" N.S.

LESS 75 Percent Discount.

ADJUSTABLE SNAP GAGES. ALL SIZES. ½ to 8".

LESS 75 Percent Discount.

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Bolt Cutters 1"-1½"-2"-2½" Acme Landis
Boring Mills, 36"-42"-52"-72"-96"
Drills, Radial 6' Cin. Bick., 5' Carlton.
Lathe, Turret 3-A W. & S. S.P.D.
Millers, Plain No. 3 K & T. No. 4 Cin.
Planer, 36"x36"x12' Powell 4 Hds.
Profiler, #13 P. & W., B.D.
Shapers, 16"-26"-24"-36"
Shaper, 36" Morton Draw Cut

West Penn Machinery Company
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LARGE LATHE

84"x52' Putnam Geared Head Motor Drive —Equipped with 2 carriages—Inspection in Operation.

SUN MACHINERY COMPANY
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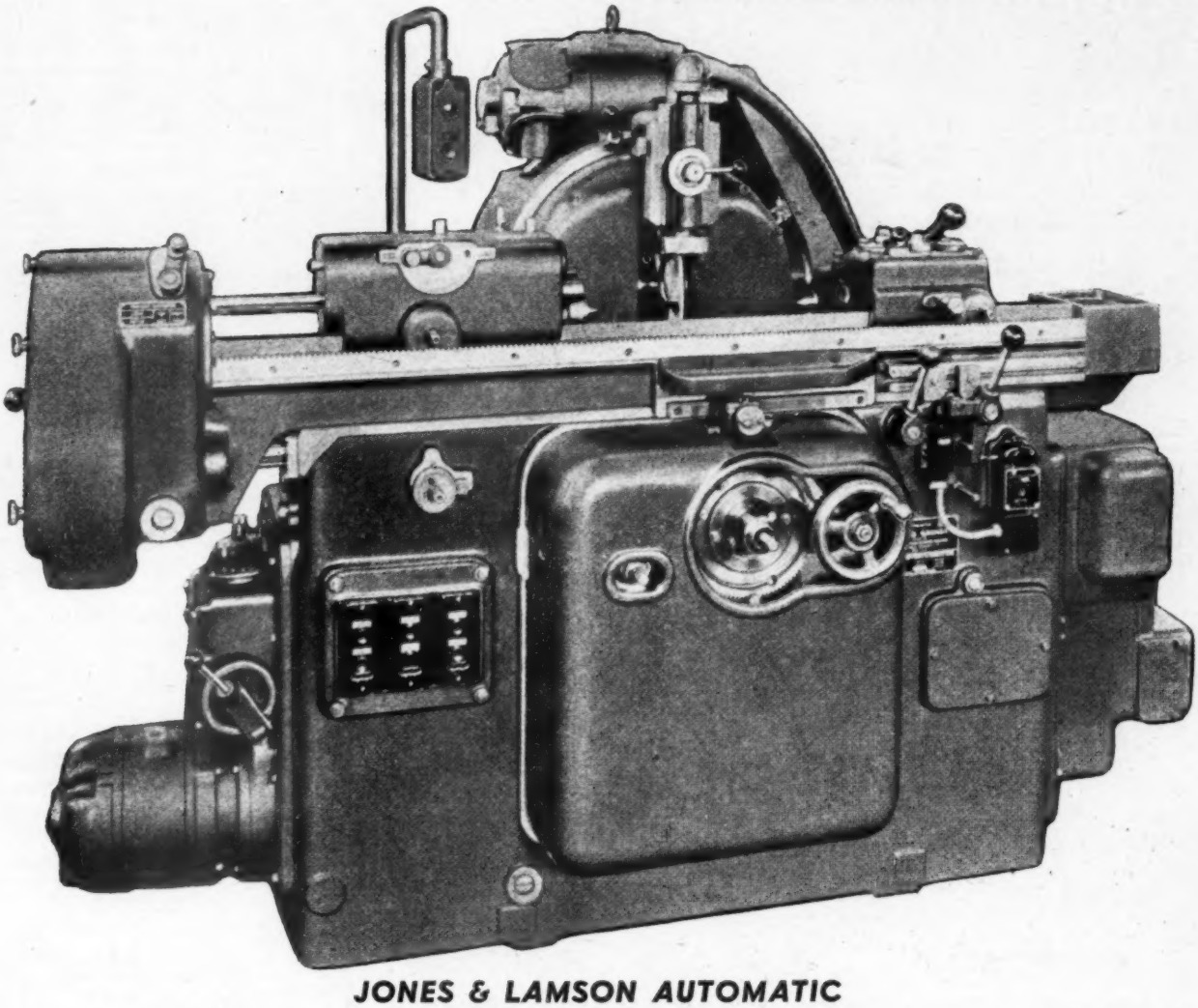
NOW
YOU CAN AFFORD A

JONES & LAMSON
AUTOMATIC
THREAD GRINDER



JONES & LAMSON AUTOMATIC
THREAD GRINDER (6" x 36")
(slightly used)

• Are your jobs short or long runs on taps, studs, gauges, hobs, worms, spindles? Here is a versatile machine, complete, with motors and many extras, ready to go to work and available right now from our warehouse stock. You can make extra profits on your thread grinding operations using the TG-636—at our prices.

Ask for complete specifications.

SPECIFICATIONS
TG-636

Maximum Thread Diameter—6"
Maximum Thread Length—12"
Maximum Work Diameter—7½"
Maximum Work Length—36"

EMERMAN MACHINERY CORP.
875 W. 120TH STREET CHICAGO 43, ILLINOIS

WORCESTER 6-5175

Call Botwinik And Be Rid of Your Machine Tool Problems In One Step

★ LATHES

1—Bridgeford 36"x56', 15 speed, grd. hed., Eng. Lathe, M.D., AC elect. equip., power rap. trav. to carr., compound rest, 2 steady rests, sw. over bed 38", sw. over carr. 26", dist. betw. cens. 48'.
1—Whitcomb-Blaisdell 20"x24', QCG, dbl. bk. grd. Eng. Lathe, M.D.
1—Amer. 24"x12', 12 speed, Eng. Lathe, M.D., sw. over bed 27½", dist. betw. cens. 84".
2—Hendey 16"x8', Mod. EBM, Eng. Lathes, 18 speeds, taper attmts.
1—Hendey 14"x6' Mod. EBM, Eng. Lathes, 18 speeds, taper attmts.

★ MILLERS

1—B. & S. No. 3A Univ. Miller, dbl. overarm, motor in base, tbl. wkg. surf. 55½"x14", power feed long. 34", cross 12", vert. 19".
1—Milwaukee No. 2 Stan. Pl. Miller, dbl. overarm, M.D. in base, tbl. wkg. surf. 50"x12½", power feed: long 31¼", cross 10", vert. 20".
1—Van Norman No. 3 Duplex Miller, with high speed mill, attmt., 12 speeds, tbl. wkg. surf. 48¼"x10", power feed: long. 32", cross 12", vert. 18⅞".
1—B. & S. No. 3B, motor in base, single overarm, Stan. Pl. Miller, tbl. wkg. surf. 60¼"x 11", 16 spin. speeds, range power feeds: long. 31", cross 12", vert. 19½".

★ TURRET LATHES

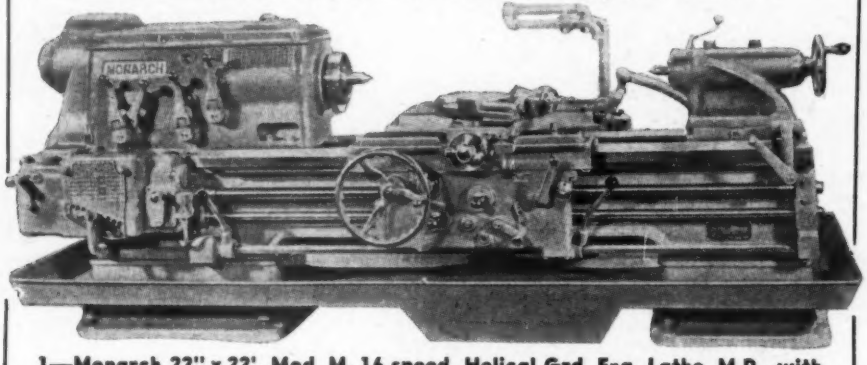
3—W. & S. No. 3 Univ. Turret Lathe, latest type, hole through spin. 1-27/32".
4—W. & S. No. 4 Univ. Turret Lathes, very latest type, pre-selective hed, hole through spin. 2-7/16".
W. & S. No. 1A and 2A Univ. Turret Lathes, latest type, timk. bear.

★ GRINDERS

8—Cin. No. 2 Centerless Grinders, very latest type, Filmatic bearings, capac. bar wk. ⅛" to 2" diam., 18' long.
9—B. & S. No. 2B Surf. Grinders, perm, mag. chuck, Roto-Clone Dust Collectors, latest type.
5—Norton 6"x18" Horiz. Surf. Grinders, M.D., latest type, capac. 10¼", perm. mag. chucks.
4—LeBlond No. 2 Univ. Tool & Cutter Grinders, latest type, fully complete, sw. 10", dist. betw. cens. 24".
3—Norton No. 2 Univ. Tool & Cutter Grinders, latest type, fully complete, sw. 12", dist, betw. cens. 28".

★ UNIVERSAL GRINDERS

1—B. & S. No. 1 Univ. Grinder, latest type, cens. sw. 10", dist. betw. cens. 20".
1—B. & S. No. 2 Univ. Grinder, latest type cens. sw. 14", dist. betw. cens. 30".
1—B. & S. No. 3 Univ. Grinder, latest type, cens. sw. 14", dist. betw. cens. 40".
1—B. & S. No. 4 Univ. Grinder, latest type, cens. sw. 14", dist, betw. cens. 60".



1—Monarch 22" x 22', Mod. M, 16 speed, Helical Grd. Eng. Lathe, M.D., with risers, sw. over bed 30½", dist. betw. cens. 168", AC elec. equip., 11-500 RPM, power rap. trav. to carr., sw. over compound 21", 16 spin. speeds, coolant pump and piping. Brand new. On original skids. Never used. Built June, 1946.

BOTWINIK BROTHERS OF MASS., INC.
3 SHERMAN STREET — WORCESTER (1) MASS.

CLOSEOUTS

BORING MILLS
HORIZONTAL
2⅛", 4" Binsee
VERTICAL
66", 120" Niles
64" Colburn, M.D., 2 hds.

TURRET LATHES
Foster Nos. 4, 5, 6, 1B, 3B M.D. Univ.
J. & L. 2¼"x24", 3¼"x36".
Acme 3¼" M.D.
No. 1L Gisholt Univ. M.D.

Hilles & Jones Straightening Rolls 6' wide by ½" cap, plate, M.D. with controls, practically new.

GRINDERS
P. & W. 14", 18", B.B., Vert. M.D.
Blanchard 30", M.D.; Modern 12x48" M.D.
Norton Hydraulic 12x18", M.D.
Heald Nos. 72A3 Gagematic
Norton 50"x28', M.D.
Landis Type A 6x20" Hydraulic, M.D.
Bryant No. 12, M.D.
No. 55, 60, 65 Heald Int. Hydraulic, M.D.
12" Heald Rotary, Arter 12" M.D.
B. & S. No. 2 Surface, M.D.
B. & S. No. 10 1 Cyl.
No. 2 Cincinnati Centerless M.D.
B. & S. No. 1, 3 Universal
#25, #55 G. & L. M.D.

LATHES
McCabe 26-42"x14'
26x12' Boye & Emmes 3 step cone, B.D.G.
14"x6', 16"x6' Hendey
9" LeBlond Automatic
36x30' Putnam M.D.
36x22" Putnam, D.C. M.D.
32"x35' Wickes
Putnam 42x16', M.D. S.C.G.
P. & W. 1x18, 1¼x18 Automatic Lathes
Monarch geared head

AUTOMATICS
B. & S. No. 2, Hand Screw
B. & S. No. 0
Cleveland Model A ½", ⅝", 1¼", 2"
Cleveland Model B 1", 2"
P & J 6A, M.D.
⅞" Cone 4 spindle

New in Stock—Power Shears
5, 10, 18 ton OBI Power Presses
7"Ammco Shapers
H.S. Vertical Milling Heads, Drill Presses, Foot Presses
Kalamazoo Metal Band Saws
8" Shap-Rite

RADIALS
4', 5', 6' American Triple Purpose
4', 5' Cincinnati-Bickford
4' Muller, M.D.; 4' 5' Western, S.P.D.
4' American Hole Wizard, M.D.
4' Fosdick

MILLING MACHINES
Cincinnati, #2 Univ.
No. 3S Cincinnati, S.P.D. rapid trav. M.D.
Nos. 1Y, 0Y, 3, 4, 5 B & S Plain & Univ.
B. & S. Nos. 12, 13, 13B
Hall Planetary Model D Thread Miller
Becker Nos. 3, AB, 5, 6, Vert.
Nos. 3, 4, Cincinnati Vert.
P. & W. No. 12, 30 Profiler, M.D.
K. & T., B. & S., No. 2, 3 like new
B. & S. No. 2, 3, Vert.
No. 8D, Gorton Vertical, M.D.
#3 Van Norman Universal
#2 Conradson Universal
#26 Van Norman

MISCELLANEOUS
Gorton No. 1S, 3Z Engraving Machine
6 spindle Avey Drill 15" overhang
Rochester No. 5½" B Hammer
6" Vertical Shaper, P & W
Oster Pipe Machines, 4", 6", 8", M.D.
N.B.P. 15" Slotter, M.D.
10x10 Peerless Universal Shaping Saw
#7, 72 Fellows Gear Shapers
Lennox Throatless shear ¼" cap., M.D.

AARON MACHINERY CO., INC.
MONA
45 Crosby St.
New York 12, N. Y.

OTT MACHINERY SPECIALS
AUTOMATICS, Acme-Gridley 6 spdle, 9/16" & 2⅝"
AUTOMATICS, Gridley, 9/16" x ⅞" Model G
AUTOMATICS, #11 Polymatic Form & Cutoff
AUTOMATICS #1 Wickman Swiss Type, used very little
CONOMATICS, 2⅝—8 spindle, M.D.
GRINDER, Norton 10"x36" Hydraulic, M.D.
LATHES, Hendey, E.B.M. type, 14"x7' M.D.
LATHES, Rockford, 10"x8' Geared Head, M.D.
MILLING MACHINES, Milwaukee #1B Universal #2, Plain, M.D.
NIBBLERS, Grey & Savage
PRESS, DDG54 Ferracute, D.A.
THREAD ROLLER, Watson-Flagg. Late type—3/16" to 2½" cap.
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OTT MACHINERY SALES, INC.
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Detroit 26, Mich.
MONA

National Bent Shank Nut Tappers—Battery of ⅝" and ⅞" Machines.
2 Landis ¾" Bolt Formers and Threaders, M.D.
1 National ½" to 1" Hot Bolt Head Trimmer
Woodward & Powell 42" x 42" x 36 ft. 4 Head Planer
Cincinnati 36" x 36" x 16 ft. Planer, M.D.
1 Lodge & Shipley 36" Swing by 44 ft. Bed, Selective Geared Q.C. Lathe, M.D.

National Machinery Exchange
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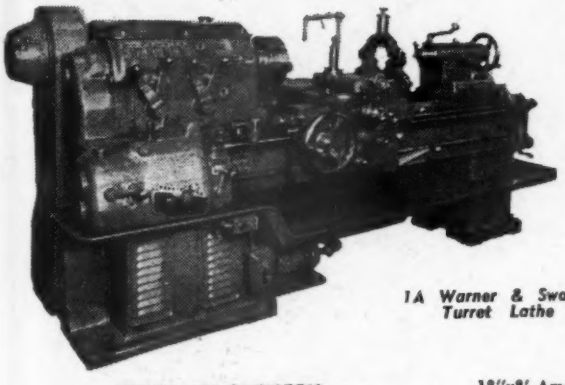
WE MEET MOST NEEDS DIRECT FROM OUR FLOOR STOCK OF 2,000 GUARANTEED REBUILT MACHINE TOOLS!



1A Warner & Swasey Turret Lathe

GEAR MACHINERY

Model T Barber-Colman Gear Hobber, m.d., latest
No. 12 Barber-Colman Double Overarm Gear Hobber, m.d.
No. 18 H Gould & Eberhardt Bear Hobber, m.d.
No. 34 Brown & Sharpe Gear Hobber, m.d.
No. 44 Brown & Sharpe Gear Hobber, m.d.
No. 61 Fellows Gear Shaper, belt
No. 64S Fellows Gear Shaper, m.d.
No. 61A Fellows Gear Shaper, m.d., latest
No. 7A, 71A Fellows H.S. Gear Shapers, m.d.
3" Gleason Straight Bevel Gear Generator, m.d.
8" Gleason Mfg. Type Straight Bevel Gear Generator, m.d.
12" Gleason Straight Tooth Bevel Gear Generator, m.d.
9" Pratt & Whitney Hydraulic Spur Gear Grinder, m.d.
10" Pratt & Whitney Hydraulic Spur Gear Grinder, m.d.
No. 2HS Lees-Bradner Hydraulic Spur & Helical Gear Grinders, m.d.
11" Gleason Straight Tooth Bevel Gear Generator
No. 4-36" Brown & Sharpe Auto. Spur Gear Cutter
No. 6-60" Brown & Sharpe Auto. Spur Gear Cutter, m.d.
No. 13LS Fellows Gear Lapper, m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
48" Cleveland Gear Hobber, m.d.
Cincinnati Gear Burnisher, m.d.
Gleason Spiral Bevel Gear Rougher, s.p.d.
Schuchardt & Schutte Gear Tooth Rounder, belt

ENGINE LATHES

14"x6' American Geared Head, m.d.
13"x48" Pratt & Whitney Geared Head, m.d. in base, taper
14"x6' Hendey Geared Head, m.d., taper
14"x6' Pratt & Whitney, cone
14"x8' Pratt & Whitney, cone
16"x6' Bradford, cone, taper
16"x6' Hendey Geared Head, m.d. taper
16"x6' Lodge & Shipley Selective Head, m.d.
16"x6' Sebastian Type H Geared Head, m.d.
16"x10' Monarch Geared Head, m.d. in base, taper
18"x7' Hendey Geared Head, m.d., taper
18"x8' Hendey, m.d.
18"x8' American Geared Head, m.d., taper
18"x8' Lodge & Shipley, cone
18"x8' Lodge & Shipley Patent Head
20"x48" centers Pratt & Whitney Geared Head, m.d. in base, taper
20"x8' Springfield Gear Head, m.d., taper
23"x12' LeBlond Geared Head, m.d., taper
24"x72" centers Lodge & Shipley Selective Head, m.d., taper, latest
24"x10' American Geared Head, m.d.
24"x10' Hendey Geared Head, m.d.
25"x10' LeBlond, cone
26"x14' Bridgeford, cone, taper
27"x16' LeBlond, cone, taper
30"x12'6" Niles-Bement-Pond, m.d., taper
30"x13'6" Niles-Bement-Pond, m.d.
30"x26' Lodge & Shipley Selec. Head, m.d., 2 carriages
32"x16' Bridgeford Geared Head, m.d., taper
36"x12' Lodge & Shipley Selec. Head, m.d.
36"x21' centers Putnam Geared Head, m.d.
36"x28'6" Niles-Bement-Pond Geared Head, m.d.
36"x30' Lodge & Shipley Selec. Head, m.d., 2 carriages
36"x32' centers Putnam Geared Head, m.d.
36"x36'6" Niles-Bement-Pond Geared Head, m.d., 2 carriages

PLAIN CYLINDRICAL GRINDERS

6x18" Landis, m.d.
6x18" Cincinnati Model EA, hydraulic, m.d.
6x32" Fitchburg Type A, m.d.
8x36" Cincinnati Saddle Type, m.d.
10x24" Landis, m.d.
10x36" Cincinnati Hydraulic, model EA, m.d.
10x48" Brown & Sharpe, belt
10x48" Landis Type C Hydraulic, m.d., latest
10x72" Landis, m.d.
No. 10 Brown & Sharpe, m.d.
No. 11 Brown & Sharpe, m.d.
No. 12 Brown & Sharpe, belt
12x36" Modern, belt
12x36" Landis, m.d.
14x48" Cincinnati Self-Contained, m.d.
12x48" Modern, m.d.
12x72" No. 16 Brown & Sharpe, belt
12x96" Landis, m.d.
14x18" Cincinnati Self-Contained, m.d.
12x48" Cincinnati Self-Contained, m.d.
14x52" Norton, motorized
16x72" Landis, m.d.
16x216" Landis Type B Hydraulic, m.d., latest
20x120" Landis Self-Contained, m.d.
26x96" Landis Self-Contained, m.d.

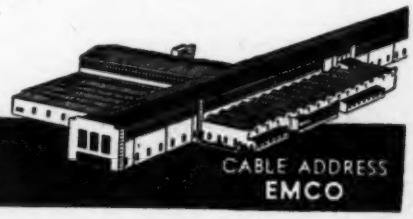
PLANERS

24"x24"x6' Pond, 1 head, belt
30"x30"x10' American, 1 head, belt
30"x30"x10' American, 2 heads, belt
30"x30"x14' Gray, 2 heads, belt
32"x32"x16' G. A. Gray, 2 heads, belt
36"x36"x10' Niles, 2 heads, belt
36"x36"x12' Powell, 2 heads, belted m.d.
36"x36"x16' Gray, 2 heads, belted m.d.
36"x36"x18' Niles-Bement-Pond, 2 heads, reversing m.d.
36"x36"x20' Cincinnati, 2 heads, belt
36"x36"x20' Gray, 2 heads, belt
38"x38"x20' Gray Spiral Drive, 2 heads, belt
42"x42"x26' Cincinnati, 4 heads, belted m.d.
48"x48"x18' Detrick & Harvey, reversing m.d., 4 heads
48"x48"x28' Cincinnati, 4 heads, reversing m.d.
48"x48"x30' Cincinnati, 4 heads, belted m.d.
48"x48"x40' Sellers, 2 heads, reversing m.d.
50"x48"x32' Niles-Bement-Pond, 4 heads, reversing m.d.
66"x60"x40' Niles-Bement-Pond, reversing m.d., 4 heads
72"x72"x24' Niles-Bement-Pond, 4 heads, reversing m.d.
72"x72"x36' Niles, reversing m.d., 4 heads
96"x72"x18' Niles, 4 heads, belted m.d.
120"x120"x20' Mesta, 4 head, m.d., latest

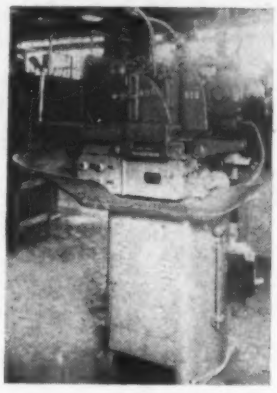
CYLINDER GRINDERS

No. 50 Heald Hydraulic, m.d., new, latest type
No. 55 Heald, m.d.
No. 55 Heald, belt
No. 65 Heald, belt
No. 73 Heald Airplane Cylinder, m.d., latest type, new

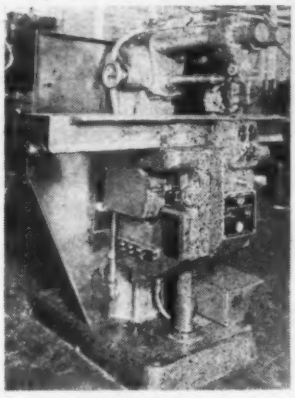
THE ABOVE IS ONLY A PARTIAL LISTING. WRITE US YOUR NEEDS. LET US QUOTE.



THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio — MElrose 1241 — CABLE ADDRESS EMCO

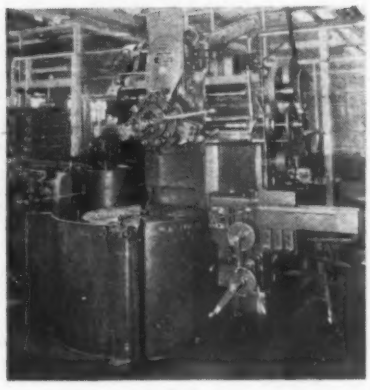


FOR SALE



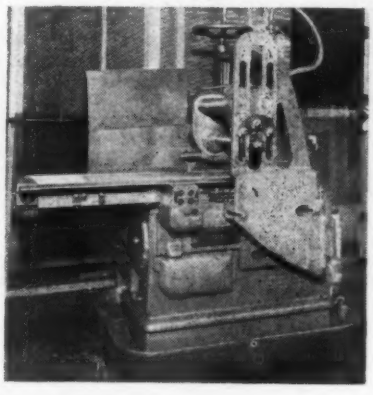
Brown & Sharpe, Model 000, Plain Miller, complete with Coolant Pump. New 1943, Bargain.

Brown & Sharpe, Model #12, Plain Miller, complete with Coolant Pump, New 1943, Bargain.



36" Bullard Vertical Boring Mill with threading — New 1944, Serial 23753, Bargain.

Brown & Sharpe, Model #10, Plain Miller, complete with Coolant Pump, New 1943, Bargain.



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BLISS 304—58 ton, 8" stroke, 18"x18" bed

BLISS 4½—75 ton, single and double act. 1½-4½" stroke, 21"x31" Bed

BLISS 6—125 ton single and double act. 2-5" stroke, 24"x31" Bed

BLISS 7—180 ton, single and double act. 1½-4½" stroke, 24"x36" Bed

BLISS 7—88 ton, 4-8" stroke, Horizontal Horning

BLISS Hydro-Dynamic 100, 150, 200 ton adj. stroke, 30"x31" Bed

BLISS 88—226 ton, 10-30" stroke

BLISS 25A—600 ton knuckle

BLISS 26A—800 ton knuckle

BLISS 27—1000 ton knuckle

CLEVE 14S—180 ton, 8-30" stroke

CLEVE 8K—800 ton knuckle, 6" stroke

CLEARING K 1800—42, 800 ton knuckle 6" stroke

TOLEDO 59½S—504 ton, 8" stroke 31"x 31" bed, twin dr.

W & F 6600-6" stroke, 10 sta. trans. slide, 3"x15" Bed

Ceco Stamps—24x48, 36x48, 48x48, 60x156
Pneumatic Drop Hammer 36x48 3000# Head
Hydraulic Presses 75 ton to 5000 ton
100,000# Draw Bench for 40 ft. tube, single, double, triple heads

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DRILL, RADIAL—FOSDICK 3½". G.B., M.D.
KEYSEATER—MITTS & MERRILL No. 6, M.D.
MILLER, PLAIN—MILWAUKEE No. 2-B Double Over-arm, M.D.
PLANER, METAL—WOODWARD & POWELL 30"x30"x8' 1 rail head, 1 side head
TURRET LATHES—FOSTER No. 1-B Univ. ine. 2 Wrenchless Chucks, etc. M.D.; also W & S No. 2-A Univ.
Available immediately—Also Many Other Tools
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NEW and USED—Hand and Power Brakes, Shears, Forming Rolls, Folders, Punches, Rotary Machines, Stakes, Spot and Arc Welders.

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GROTNES TIRE SHRINKER

Capacity 6 to 8 Rims per minute. Diameter of jaws fully contracted 34". Motor driven. Specifications by request.

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SENECA FALLS 4" LO SWING PRODUCTION LATHE

VERY LOW PRICE on this powerful high production lathe. 60" centers; geared head; 9 speeds on carriage, 6 speeds on spindles; 8 tools and cross slides; 5 h.p. 3 ph. AC motor; hardened steel ways and gears. For work on heavy steel forgings; does several operations at one time.

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306 ROSEDALE ST., ROCHESTER, N. Y.

FOR SALE

10' Niles Vertical Boring Mill

80" dia. Table—Vee Drive

CANAL MACHINERY
176 Lafayette St., New York, N. Y.

ENGINE LATHE

48"x22' Niles-Bement-Pond Geared Head Motor Drive—Purchased new 1941—Very Attractive Price Before Removal.

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BORING MILLS

9" Bar BETTS Horizontal floor type, 50" face plate, 8'—vertical travel, modern, 4-motors.

3" & 4½" Bar Universal TRI-WAY Horizontal Boring Mill, P.R.T
No. 35 LANDIS Horizontal floor type
24" New Era, BULLARD
52" & 72" KING, Two Swivel Heads.
96" CINCINNATI, 2 swivel heads.
12' BETTS Heavy, Double Drive.
14' BETTS (consolidated) late type.
14-20' N.B.P. Extension type boring—2 swivel heads, all geared feeds
No. 1 PUTNAM car wheel Borer.

MILLERS

24"x24"x16' INGERSOLL Planer type.
36"x36"x10' INGERSOLL Slab
Nos. 2 and 4 CINCINNATI High Power Vertical, Power rapid traverse.
No. 5 CINCINNATI Plain Rectangular overarm table 83"x21".
No. 3-36 CINCINNATI Duplex Hydromatic
6"x14" PRATT & WHITNEY, thread.

LATHES

24"x32' AMERICAN 12 Speed G.H.
30"x18' AMERICAN, 12 Speed, G.H.
36"x32' NILES, "Timesaver".
42"x34' LEBLOND late type
30"x34' LEBLOND Gun Boring.
42" PUTNAM Car Wheel Lathe, G.H.
48"x70' N.B.P. Engine Lathe.
48"x30' SIMMONS, Geared head.
60"x30' NILES Heavy Duty Geared Head, M.D. (Built 1942).
60"x40' Centers MACKINTOSH-HEMPHILL Heavy Duty Geared Head M.D. (Built 1942).
90" PUTNAM Driving Wheel Lathe with journal truing and Double Quartering
No. 2-H LIBBY, Full Universal Cross Feeding Turret, Taper Attachment, M.D.

DRILLS

8' AMERICAN Triple Purpose Radial, Motor-on-Arm, 230-V., D.C.
Nos. 310 & 314 BAKER H.S.

GRINDERS

No. 2 CINCINNATI centerless grinder.
24"x20' Centers NORTON Plain. Cylindrical individual motor drive to work spindle, wheel spindle and table.
20"x96" LANDIS, plain cylindrical.

GEAR HOBBERS

No. 5 Pfauter, spur, helical and worm, 130" dia. capacity.

100" GOULD-EBERHARDT, Horizontal, for spur, helical and worm gears, capacity diameter 101" face 48".

PLANERS

48"x48"x20' N-B-P 4 heads.
48"x48"x32' GRAY Spiral Drive, four heads.
72"x72"x15' N.B.P. 4 Hds, 230-volt.

14'x9'x35' Capacity Detrick & Harvey Convertible openside, 2 rail heads, 2 side heads, traveling outer support, 230 V.D.C.

60"x60"x18' CLEVELAND Openside.
84"x60"x18' DETRICK-HARVEY Convertible Openside, 230-volt, D.C.
120"x96"x20' CINCINNATI Rapid Traverse, 230 volt, D.C. reversing type planer motor and control, 4 heads.

SHAPERS—SLOTTERS

6" & 10" PRATT & WHITNEY Vertical.
15" BETTS Heavy Slotter.
18" NILES-BEMENT-POND Heavy Slotter.
21" NILES-BEMENT-POND Slotter, M.D.
36" MORTON Drawcut, Rotating Arbor, Geared Feeds, P.R.T., M.D.

MISCELLANEOUS

1½"x1½" CLEVELAND Punch 42" Throat
30"x⅞" N-B-P Bending Rolls
No. 2 PRATT & WHITNEY Jig Borer with 22"x44" table.
60" NEWTON Cold Saw, M.D.
No. 55 NEWARK Spur Gear Cutter.
48" MORTON Keyseater

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28" Cincinnati Bickford, Sliding Head.
32" Cincinnati Bickford, Sliding Head.
6' American, Radial.
4' Fosdick, Radial.

GRINDERS

#33 Abrasive, Surface.
Model B Thompson, Hydraulic, 12"x24" Surface.
#3 Cincinnati Centerless.

LATHES

14"x6' LeBlond Geared Head.
15"x6' Sidney.
16"x6' Porter-McLeod, Geared Head.
16"x7' Lehman Hydratrol, Geared Head.
17"x6' LeBlond, Taper Attachment.
19"x8' Sidney.
36"x14' Bridgeford, Geared Head.

MILLERS

#2 S.P. Van Norman, Plain.
#2 Cincinnati, Vertical, Dial Type.
#3 Cincinnati, Plain, High Speed, Dial Type.
#4 Cincinnati, Universal.

TURRETS

#3B Foster Universal.
#2A Warner & Swasey.
#4 Warner & Swasey.

DELTA EQUIPMENT CO.

148 N. 3d Street Phila. 6, Pa.

MACHINE TOOLS

16" x 72" Norton Type "C" Plain Grinder
#18 Blanchard Surface Grinder, 42" Chuck
24" x 72" American "New Type T" Engine Lathe
#3 Warner & Swasey Universal Turret Lathe
#4 Warner & Swasey Universal Turret Lathe
#2L Van Norman Plain Miller
7½"- 6-spindle Goss & DeLeeuw Automatic Chucker
8" x 48" J. & L. Thread Grinder
3'-11" Carlton Radial Drill
#262 Barnes Box Column Upright Drill.

ALL LATEST TYPE MACHINES

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350 Waterman St., Providence 6, R. I.
Dexter 8880

LATE TYPE TOOLS
(All Motor Driven)

10x72 Norton Plain Cylindrical Grinder, 1942.
10x30 Norton Plain Cylindrical Grinder, 1942.
36" Bullard Vertical Boring Mill, spiral drive, 1942.
#7A Jones & Lamson Universal Turret Lathe, saddle type, bar and chucking equipment, 1942.
#1-18 Cincinnati Plain Automatic Miller, 1944.
#1-12 Cincinnati Plain Automatic Miller, 1941.
#70A Heald Internal Grinder, $1500.00.
#25A Heald Rotary Surface Grinder.
#13 B&S Universal Grinder.
#12M Morey 2-spindle Vertical Profiler.
#2 Bardons & Oliver Turret Lathe, 1944.
#7 Bardons & Oliver Universal Turret Lathe, bar feed.
#4 Warner & Swasey Universal Turret Lathe.
#5 Jones & Lamson Universal Turret Lathe.

REYNOLDS MACHINERY CO.

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GAspee 5187

H. & J. 8 ROLL

Plate Straightening Machine
Cap. ½" x 72", M. D.
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LATHES

8"x108" Fitchburg Lo-Swing
12"x18" Lipe Carbo
18"x6' American Grd. Hd.
20"x10' Lodge & Shipley Grd. Hd.
36"x30' Lodge & Shipley Triple Geared Selective Head, two carriages
42"x18' Putnam Geared Head

MILLING MACHINES

No. 2H Milwaukee Vertical, latest type
#3 Milwaukee Vert. M.D.
#3K Milwaukee Vert.
No. 4 Cincinnati Plain, Motor Drive
No. 4K Milwaukee Plain Late Type
No. 118 Van Norman Production
24" Cincinnati Production
Taylor & Fenn Spline
No. 27MB Smalley General Thread
#2 Hanson-Whitney Thread
No. 6 Lees-Bradner Thread
26"x25"x12' Ingersoll Adjustable Rail
42"x36"x14' Ingersoll Adjustable Rail, four heads

DRILLS

No. 2-8 Spdl. Leland-Gifford
7' American full Universal Radial

VERT. BOR. MILLS

34" King
42" Bullard New Era Vertical Turret
72" Colburn, Motor Drive
72" King, Motor Drive

HOR. BOR. MACHINES

No. 50 Universal, 5" Bar, 60x144" Table, Maximum Bar to Table 72", Maximum Bar to Outboard 120".

GEAR HOBBERS

No. 4 Pfauter, 72" Capacity

PLANERS

36"x36"x8' Woodward & Powell
60"x38"x8' Gray Spiral Geared

TURRET LATHES

No. 2 Brown & Sharpe, Wire Feed
#3 W & S Univ. Bar Feed
#4 W & S Univ. Speed Selector
No. 1-A W & S Univ. Speed Selector
#4—W & S 1¼" Screw Machine
#6—W & S 2" Screw Machine
#6R Denver Univ. 2-9/16" capacity
18" Libby—3½" Hole—M.D.

AUTOMATICS

1⅜" Conomatic, 8 Spdl.

GRINDERS

6"x18" Norton Hydraulic Plain
6"x30" Norton Hydraulic Plain
23"x36" Norton Plain, M.D.
14"x168" Norton Plain, Late Type
#22—12" Heald Rotary Surface
10"x24" Landis Universal, M.D.
No. 16 Blanchard Surface, 26" chuck

HILL-CLARKE
MODERNIZED & MOTORIZED
CYLINDRICAL GRINDERS

SIZES AVAILABLE

10x18	14x36	16x 50
10x36	14x50	16x 72
10x50	14x72	18x 96
10x72	16-24x50 Gap	24x 96
10x96		24x240

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MACHINERY COMPANY
651 Washington Boulevard
Chicago 6, Illinois

LATEST MODELS

No. RD1175J Walker Turner Radials, M.D. (4)
3'11" American "HOLE WIZARD" Radial (1942)
3'11" Morris "MOR-SPEED" Radial (1942)
7'17" Fosdick Radial (1942)
24" Bullard Vert. Turret Lathe, Spiral Drive
72" King Vert. Bor. Mill, Side Head (1942)
#340-F Giddings & Lewis Mill (1942)
#2 K & T Rotary Head Die Miller (1943)
No. 1H-12 Kearney & Trecker Mfg. Miller (1941)
No. 5H Kearney & Trecker Pl. Miller (1941)
No. 0 Brown & Sharpe Wire Feed (3)
No. 3 Warner & Swasey Univ. Turret, Timken (1941)
No. 4 Warner & Swasey Univ. Turret—1942 (4)
No. 5 Warner & Swasey Univ. Turret—1942
No. 5—2½" Jones & Lamson Univ. Turret—(1942)
No. 1A Warner & Swasey Turret, Timken (3) 1941
No. 2A Warner & Swasey Turret, Timken (2) (1941)
No. 11 Blanchard (2), (1942)
No. 18 Blanchard—(1942)
No. 4T Sellers Tool Grinder (never Used)
72A3 Plain Heald Internal Grinder, 3 motor drive for Tool Room—(1942)
4"x12" Landis Type C Plain Grinder, (1942)
14"x168" Norton Type C Plain Grinder, M.D. (1942)
13"x4' & 5' bed South Bend M.D. Lathes (3)
22"x96" Monarch Model "M" Lathe (1944)
42"x132" Centers American Lathe, M.D. (1942)
50"x17' Centers LeBLOND Lathe, M.D. (1942)

Wigglesworth Machinery Co.
203 Bent St. Cambridge, Mass.

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IMMEDIATE DELIVERY FROM STOCK

No. 4½ BLISS, 80-100 Ton Capacity straight side punch press, late model with scrap cutters, double roll feeds, bolster. 10 H.P. motors and controls, forced feed lubrication. 21x27 bolster 4½" stroke. In both Single and Double Action Models. Like new.

No. 6 BLISS, 90-125 Ton Capacity, straight side Punch Presses, late model. With scrap cutters, roll double roll feeds, bolster, 15 Hp motors and controls, forced feed lubrication. 25x30" bolster, 5½" stroke. In both Single and Double action models. Like new.

4½—75 ton straight side punch presses adjustable strokes, late model, motorized.

375 Ton ELMES Hydraulic Press, 48x64 bed, comp. with all standard equipment, new 1943.

SPOT WELDERS IMMEDIATE DELIVERY 5-300 KVA, Brand new. 5 year guarantee.

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UPSETTER, M. D.
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AIR COMPRESSORS ER-1, 12x10 AC Motor Drive, 275 CFM (4)
MILLING MACHINE, K & T M-24 Simplex
MILLING MACHINE, 8-8 CINCINNATI, (rise and fall att.)
MILLING MACHINE, LeBlond #3 Plain
CHUCKERS, NEW BRITAIN GRIDLEY, 4 sp. No. 412, (3)
LO-SWING AUTOMATIC LATHES 14"x32" (8) 5"x22" (3)
SLAB MILLERS 36"x30"x14' Ingersoll
CLEVELAND HOBBING MACHINE CO. 8 sp. RIGIDTURNER
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1-TON—Whiting 33' Span
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P & H 34' Span
2-TON—Louden 19'2" Span
Box 36'9" Span
Detroit 28' Span
3-TON—Shaw 33' Span
P & H 25' Span
Northern 22' Span
Manning, Maxwell, & Moore 48¾'
"Conco" 48' and 26'6" Spans
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38'10½" Span D.C.
Northern 30'9" Span
Milwaukee 70' Span
Milwaukee 66'9" Span
Manning, Maxwell, & Moore 70' Span
Manning, Maxwell, & Moore 47'4" Span
Shaw 36' Span
Champion 37'6" Span
American 70' Span
American 47'4" Span
6-TON P & H 77' Span
American 77' Span
7½-TON—Shepard 36' Span
10-TON—Shaw 68' Span
Shaw 73' Span
P & H 30' Span
P & H 87'6" Span
P & H 80' Span
Northern 71'10½" Span
Northern 60' Span
Morgan 55'6" Span
Morgan 39'5" Span
Morgan 52'3" Span
Milwaukee 66'9" Span
McGill 85' Span
Lane 50' Span
Emsee 75' Span
Dominion 35' Span
Cleveland 38½" Span
Cleveland 50' Span
Alliance 71'10½" Span
Alliance 58'9" Span
Albany 60' Span
15-TON—Whiting 71'-10½" Span
Northern 53' Span
Erie 60' Span
Chesapeake 55'6" Span
Case 51' Span
20-TON—Shepard Niles 49'6" Span
P & H 51'4" Span
Northern 60' Span
Morgan 60' Span
Cleveland 65' Span
25-TON—Whiting 106' Span
Tysaman 60' Span
P & H 70' Span
Morgan 52'3" Span
Cleveland 106' Span
Case 63' Span
Bedford 56' Span
30-TON—Whiting 80' Span
P & H 80' Span
P & H 60' Span
Morgan 30' Span
Case 41' Span
35-TON—Bedford 50' Span
Northern 22' Span
50-TON—Shaw 95' Span
Shaw 69'10" Span
Dominion 80' Span
Cleveland 71'10½" Span
75-TON—Morgan 59'2½" Span
Alliance 78' Span
Alliance 37' Span
80-TON—American 40'6" Span
125-TON—Morgan 100' Span
150-TON—Whiting 50' Span
175-TON—Morgan 54' Span
200-TON—Alliance 100' Span

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MAKER	MACHINE & MODEL	REDUCED PRICES
Excello Borematic	Model 2112A 12"	$ 720.00
	Double End 1212A 12"	1164.00
Heald Borematic	#48 & #48K	714.00
	#49 Single	1116.00
	#49 Double	1216.00
Haskin Tapper	1BB	87.00
	2C	132.00
	3C	148.00
	3C Double Spindle	307.00
Garvin Tapper	2X	171.00
	3X	256.00
Pratt & Whitney Profilers	12B Single-Spindle	731.00
Morey Profiler	12M 2-Spindle	742.00
U. S. Millers	Model MM1-60	366.00
Sundstrand Rigidmil	#00	464.00
	#1	854.00
	#3	928.00
	#33	1550.00
Kent-Owens	#1-14	534.00
	#2-20	917.00
Kearney & Trecker Simplex Millers	12-24	1226.00
	18-24	1422.00
	18-36	1516.00
	18-54	1662.00
Cincinnati Millers	#0-8	459.00
	#2-24	1158.00
	#3-24	1257.00
	#4-36	1787.00
	#5-48	2222.00
Van Norman	#3-V	2124.00
Reed Prentice	#3VG	801.00
Kearney & Trecker Vertical Millers	#2H	1648.00
	#2K	2045.00
	#3K	2663.00
	#4K	3122.00
Heald Rotary	12" #22	1235.00
	16" 25A	1960.00
	24" 25A	2439.00
Arter Rotary Surface Grinder	8"-A1	1022.00
	12"-A3	1380.00
	16"-A3	1494.00
Heald Internal Grinders	#81 Sizing	1499.00
	72A3 Sizing	2008.00
	72A3 Internal	1327.00
	72A5 Internal	1415.00
Bryant Internal Grinder	16-16	1475.00
	16-22	1668.00
	24-36	2427.00
	16-38	1800.00
Cincinnati Centerless Grinders	2EA 3½"	1200.00
	3EA 6"	1676.00
Norton Plain Grinders	Model C 6 x 18	986.00
	Model C 6 x 30	1075.00
	Model C 10 x 18	1731.00
	Model C 10 x 36	1836.00
	Model C 10 x 96	2131.00
Brown & Sharpe #5 Plain Grinders	3 x 12 / 3 x 18	848.00
Fellows Gear Shaper	#3	635.00
	#7125	1160.00
	#725A	1236.00
	#615A	1983.00
	#71	890.00
	#7A	972.00
	#72	1334.00
	#61A	1934.00
	#61	1506.00
Gould & Eberhardt Gear Hobber	12H	1474.00
Barber Colman Gear Hobber	Type A 12 x 12	1436.00
	Type D 14 x 14	2552.00

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⅝" & 2" Cleveland Model B
12"x63" & 14"x19" Fay
14"x18" Monarch Magna-Matic
6"x6¾" Goss & DeLeeuw
No. 454 New Britain chucking
Gisholt simplimatic

BORING MILLS

100" Niles Bement Pond heavy pattern
96" Cincinnati Massive Pattern
60" Colburn
53" Niles Bement Pond
42" & 24" Bullard V.T.L.

DRILLS

4' Hammond sensitive radial
18" Walker Turner radial
No. OOS Natco
Garvin duplex
21"x74" Munson double end
4-spdl. #3 Leland Gifford
24" Kokomo upright
34-spdl. #30 Natco

LATHES, TURRET

Nos. 4 & 5 Warner & Swasey universal
Nos. 3-B & 5 Foster universal
No. 5 Jones & Lamson
16"x6' South Bend
Nos. 3 & 5 Foster
24" & 42" Bullard vertical
28" Gisholt
3"x36" Jones & Lamson

PRESSES

12 ton U.S. OBI
#10 Bliss straight side
#5 Bliss Stiles type
8 & 20 ton General Flexible
35 ton Metalwood straightening
65 ton Watson Stillman straightening
500 ton Southwark hydraulic
1000 ton Lake Erie hydraulic

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16" Gemco (new)
20" American
24" Gould & Eberhardt
32" Morton draw cut

UPSETTERS

1" National
2½" National, latest type with air clutch & guided ram
3" National

MISCELLANEOUS

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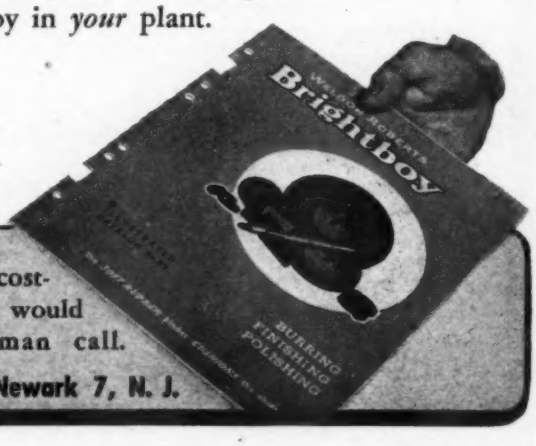

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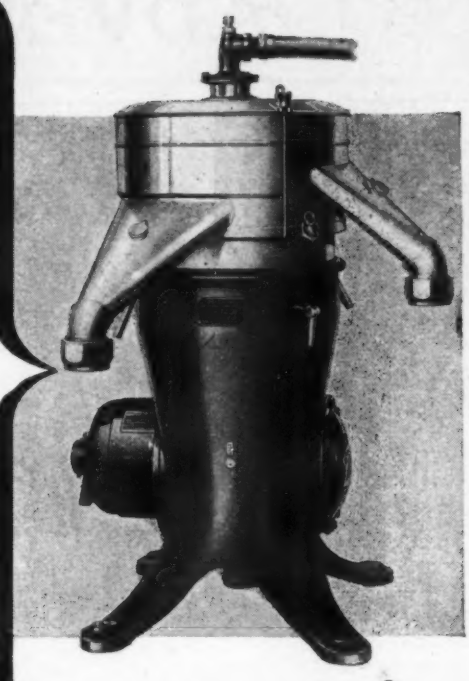

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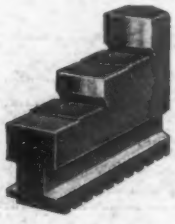
CHUCK JAWS

CORRECT JAW SELECTION AND USE MAKES SETUP EASIER, FASTER SAFEGUARDS EQUIPMENT, WORK

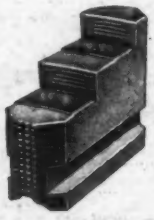
These are the standard jaw styles regularly furnished with Cushman Chucks with a brief outline of the purposes for which they are used. When ordering, specify the jaw equipment required and then make sure that your operators use it correctly. Usually time will be saved and work spoilage prevented by using jaws specifically recomended for the work-piece rather than by "general purpose" setups.

THESE ARE STYLES OF STEP AND END GRIP FURNISHED ON CHUCKS JAWS AS SPECIFIED IN CATALOG



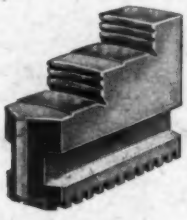
SMOOTH STEP GRIP AND SMOOTH FLAT END GRIP

Smooth grips have accurately machined surfaces to prevent marring of finished work.



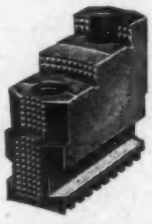
HORIZONTAL CREASED STEP GRIP SQUARE POINT SERRATED END GRIPS

Creased grips act to prevent the longitudinal movement of work. Serrated ended grip is used for rough work pieces such as bar stock.



CREASED STEP GRIP SMOOTH POINTED END GRIP

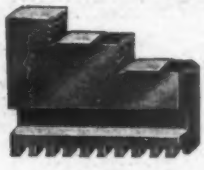
Serrated step grips recommended for rough work pieces where marring the finish is not a problem. Smooth pointed end grip used where finished bar stock is to be turned.



SQUARE POINT SERRATED STEP GRIP SQUARE POINT SERRATED END GRIPS

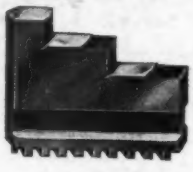
Type of jaw equipment used on chucks handling rough, unfinished work only.

THESE ARE STYLES OF JAWS FURNISHED WITH CUSHMAN CHUCKS AND IDENTIFIED IN CATALOG BY STYLE NO.



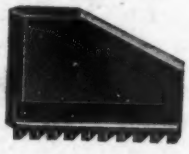
STYLE 1

For holding work on external surfaces. Designed for holding forgings and castings on the O.D.



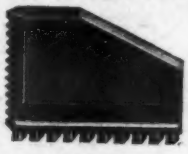
STYLE 2

For holding rings or tubular shaped pieces on the I.D. Also for holding bars or rods within capacity of body center.



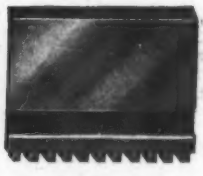
STYLE 3

Commonly used on chucks holding arbors etc. Standard jaw equipment for milling machine tooling.



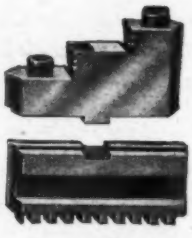
STYLE 4

Commonly used for holding rough bar stock with extra work grip to prevent slippage on roughing cuts.



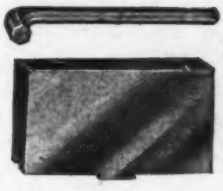
STYLE 5

Commonly used soft and formed to properly engage work pieces of irregular contour or outline. Also used for 2nd operation work to provide soft gripping bites to prevent marring of work surfaces.



STYLE 6

Designed to American Standard dimensions to permit interchange of top jaws from one chuck to another of like size and type master jaws. The design permits mounting of special top jaws of irregular or standard forms providing widest possible range of work-holding equipment.



STYLE 7

Used in the same manner as Style 5 on chucks equipped with Style 6 master jaws.

Consult CUSHMAN

Chucking Engineers Since 1862

THE CUSHMAN CHUCK COMPANY
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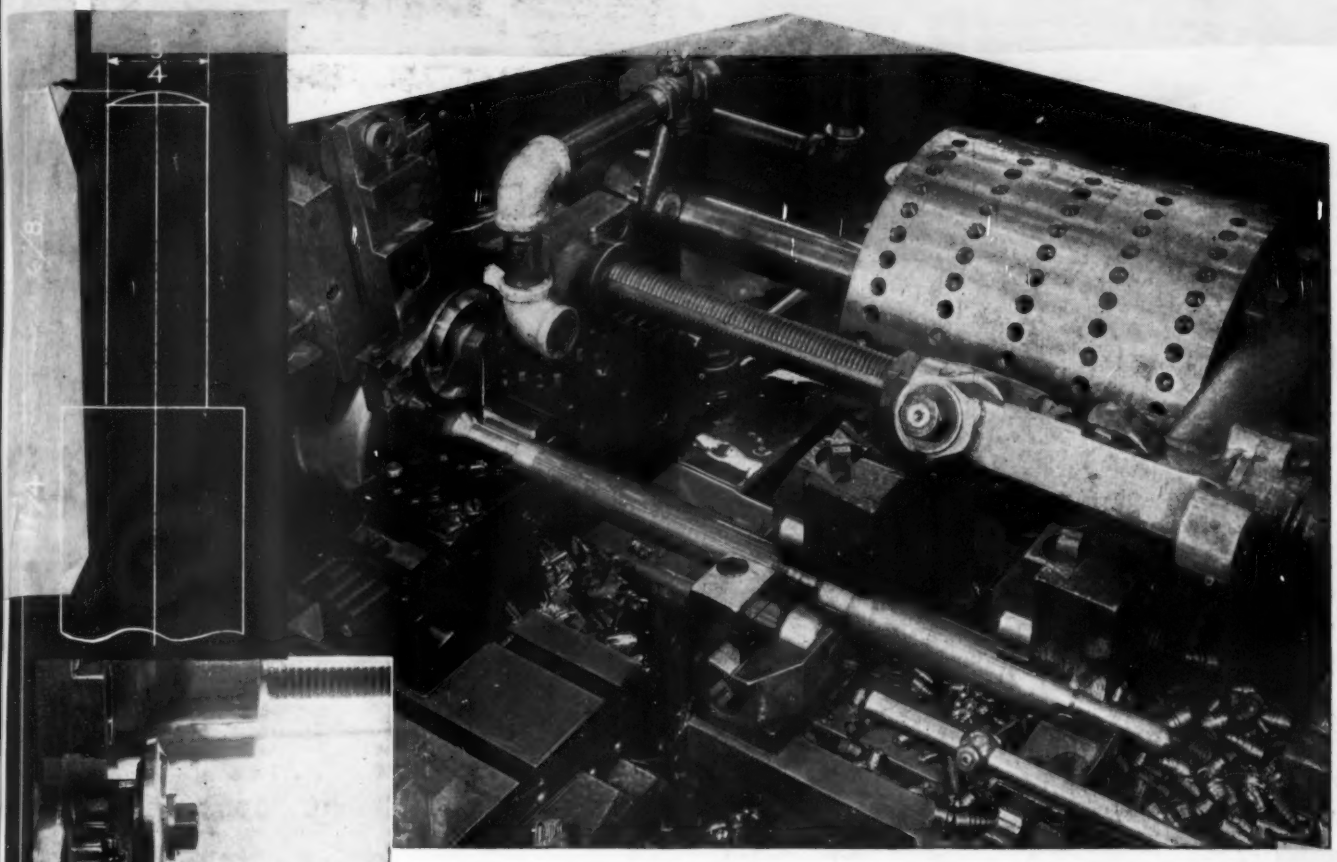

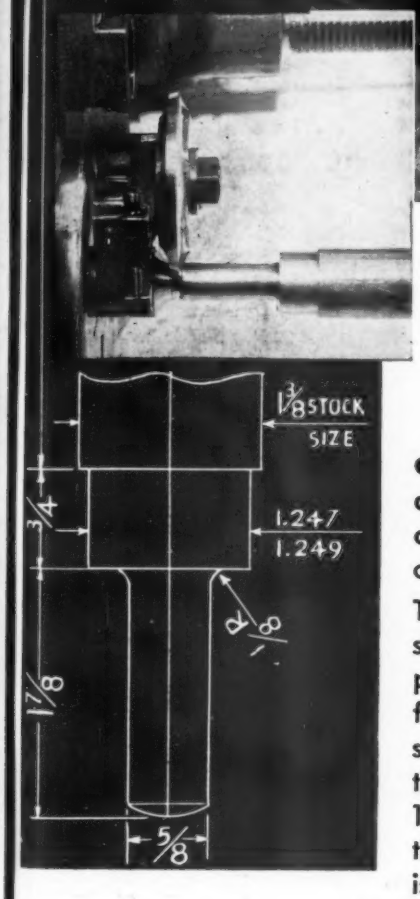

For High Speed Production of SHAFTS and SPINDLES

● This 22 5/16″ shaft, produced from 1 3/8″ 1020 cold rolled steel bar at the rate of 25 per hour on a Cleveland Automatic, offers a typical demonstration of the productive usefulness of the B type combination of automatic milling slide and double cross slide.

The machine is a Cleveland Model B 1½″ x 18″. Handling of the shaft and its fast production are accomplished with the following simple set-up. On the milling slide, a three-roller steady rest is located for the stock diameter (1 3/8″) and a combination tool turns and steadies the ¾″ thread diameter. The rear cross slide forms the ⅝″ thread diameter, including radius. The front cross slide forms the 1.249 diameter to size, both cross slides completing their work during the turning time. The independent cut-off, with a circular cut-off tool, is set to cut off and radius the back end of the shaft and radius the front of the incoming piece simultaneously.

Just another example of day in and day out cost cutting with Clevelands. Let us propose cost cuts for YOUR production.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

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